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F. A. WIRT, President — RAYMOND OLNEY, Secretary-Treasurer

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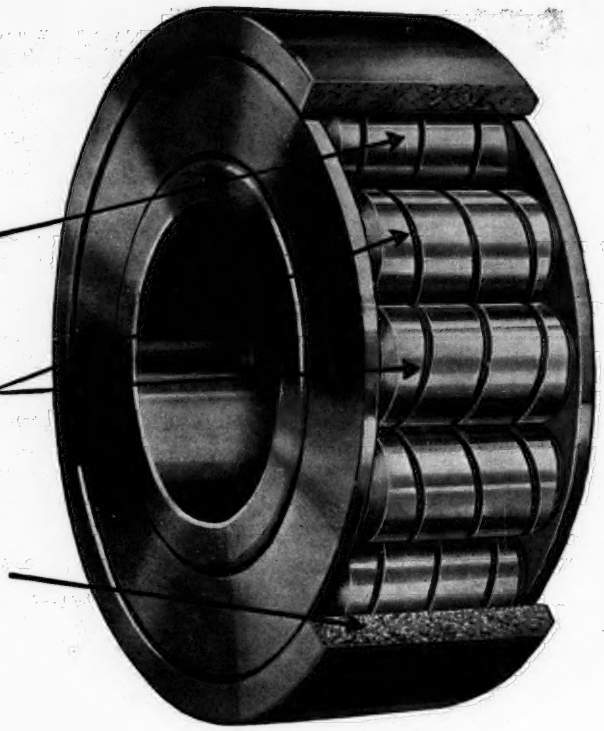

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AGRICULTURAL ENGINEERING

The Journal of Engineering as Applied to Agriculture

RAYMOND OLNEY, Editor

Vol. 6 NOVEMBER, 1925 No. 11

EDITORIALS

A Research Survey

THE U. S. Department of Agriculture is to undertake a survey of the status of research in mechanical farm equipment in this country. This survey is the outcome largely of a joint request by the American Society of Agricultural Engineers and the National Association of Farm Equipment Manufacturers for an investigation of this sort.

In view of the increasing attention that is being given to ways and means of lowering farm production costs and the more general recognition of the place and importance of labor-saving equipment in connection with this effort, the need of more research in farm equipment is coming to be more generally recognized, a fact which agricultural engineers have long realized and, in fact, have done yoeman service for years to bring about a more general appreciation of the situation.

There are many pressing problems in connection with the development and improvement of farm equipment that demand attention. Engineering is as important a factor in developing agriculture and putting it on a more efficient and economical basis as it is in manufacturing. Failure to recognize this fact accounts largely for the unfavorable situation in which agriculture finds itself today as compared with the manufacturing industry. Development of agriculture in the future, therefore, must be more than ever along engineering lines. Such development naturally is dependent on and must be preceded by some necessary fundamental research.

To carry out the program of the Department of Agriculture in connection with farm-equipment research, an advisory council comprised of representatives of the Department, the A.S.A.E., and the N.A.F.E.M., has been appointed by the Secretary of Agriculture. The survey will be actively conducted by J. B. Davidson, professor of agricultural engineering at Iowa State College, whose appointment goes a long way toward insuring the success of the effort at the outset. An announcement will be found elsewhere in this issue.

Incidentally, it will be of interest to agricultural engineers to know that thirteen of the nineteen members comprising the advisory council which has been appointed by the Department of Agriculture are members of the American Society of Agricultural Engineers. This effort is a distinct compliment to agricultural engineers, and moreover is of special significance and importance to the agricultural-engineering profession. It seems destined to be one of the important milestones in the development of the profession. The activities which Prof. Davidson will undertake in connection with this survey merits the best cooperation and support which agricultural engineers are in position to give.

Better Farm Homes

AGRICULTURAL engineers for the most part were born and raised on farms. They are alive, therefore, to the necessity of raising the standard of living on the farm, if farm life is to be made sufficiently attractive to the better class of our people who should be operating our farms. Much progress has already been made in the direction of making farm homes more comfortable, more pleasant, and efficient, but with all this only a bare start has been made. Much remains to be done, and the problem is one which calls for the knowledge and experience of the agricultural engineer for its solution.

As announced elsewhere in this issue, a Better Farm Homes Conference, sponsored by the Farm Structures Division of the American Society of Agricultural Engineers, will be held early next year. It is anticipated that this conference will pave the way to a more united effort on the part of all organizations and agencies interested in promoting household engineering as applied to the farm home. As pointed out by the present chairman of the Farm Structures Division in an editorial some time ago on this page, we, as agricultural engineers, have made considerable progress in engineering the farm but we haven't given as much attention as we should to engineering the household. This is most important and it is hoped that agricultural engineers will give greatly increased attention to this important phase of engineering agriculture.

The New Reclamation Policy

MANY millions of dollars of public money have unquestionably been wasted in federal reclamation projects. Settlers on many of these reclaimed areas have endured hardships and suffered untold losses as the result of an inadequate reclamation policy. For those who make it their business, seemingly, to criticise the government for the way it has handled many of these irrigation projects, there will be found plenty of evidence on which to base such criticism.

The agricultural engineer, knowing the difficulties encountered, is not given to wasting much effort in criticising the government for not having formulated a policy that would adequately meet the requirements of both the settlers and the government. But he is interested in finding a remedy for the mistakes of the past. If mistakes have been made in the past, what can be done to prevent their recurrence?

The failure of federal reclamation, insofar as it may have failed, may be summed up in a nutshell by saying that it did not go far enough. As Dr. Elwood Mead, U. S. Commissioner of Reclamation, points out elsewhere in this issue, Congress realized at the outset that reclamation required money and skilled engineers, which were provided. It did not, however, realize that money and expert advice were needed to change sagebrush deserts into productive farms, which were not provided. The launching of irrigation projects was not always preceded by a survey of the agricultural possibilities of the land to be reclaimed. Not enough care was taken in the selection of settlers. The proper training and other assistance given to the settlers was likewise ignored.

Granting that many serious mistakes have been made in connection with the reclamation projects carried on by the government, the tremendous benefit of these projects to the states in which they are found must not be ignored. Dr. Mead points out where communities and states have been greatly benefitted by these projects, and their establishment may be justified on this ground alone.

Reclamation by irrigation is destined to failure if it stops with providing large irrigation works and leaving the settlers to work out their own salvation. To quote Dr. Mead, "Without skilled farmers working with good tools, owning good stock, and using science and skill in cultivation, much of the money spent on construction will be thrown away."

The new reclamation policy which is gradually evolving will unquestionably place proper emphasis on all the things that are essential to make reclamation a success from the standpoint of both the government and the settler. Carrying out this new reclamation policy is logically a task for agricultural engineers, and its successful accomplishment will require the best skill which the agricultural-engineering profession can provide. The task presents a real challenge which the agricultural engineer accepts eagerly.

The Problems of Federal Reclamation*

By Elwood Mead

Hon. Mem. A.S.A.E. Commissioner of Reclamation, U. S. Department of the Interior

THE Federal reclamation act was passed by Congress twenty-three years ago and it has been in operation long enough to enable us to appraise its merits and defects. The time has now come to determine carefully what changes are needed in its methods and policies in order that it may be an effective instrument in the future conquest of aridity in the West, and to bring into use the neglected lands of the humid sections of the country.

The purpose of this act was to create opportunities for home making on the public land of this country. These opportunities in the past have done more than any other single influence to shape our national growth and the character of our people. Free land was an opportunity that called the vigorous and self-reliant from the hills of New England and from the farms of England, Germany and Scandinavia. It gave to the pioneer his confident and hopeful character, but it also made him migratory and speculative. It did not create good farmers. On the contrary, our agriculture has been the most wasteful of soil fertility of any civilized country.

The pioneer has thought more about selling out at a profit than of creating a permanent home.

The westward march of settlement continued without interruption until it reached the land of scant and uncertain rainfall, and in a brief period it encountered obstacles that the individual working alone could not overcome. The development of irrigation imposes laws of its own which must be observed.

In the settlement of the humid region, the pioneer had been an aggressive individualist. His doctrine was that every man should hoe his own row and take care of himself, but this cannot be continued under irrigation. People who live under irrigation canals must cooperate. They are bound together by their common tie of dependence on the stream and canal. Irrigation protects them from the uncertainties and vicissitudes of rainfall, but they have to pay for this insurance.

To create an irrigated farm is a much more difficult undertaking than to create a farm on the level plains of Iowa or Illinois. Moreover, the man who succeeds as an irrigator must be a good farmer. Only the skilled cultivator survives. It is no accident that the best cultivated farms on this continent are found under irrigation canals. Those around Greely, Colorado, rival the best of the Lothians in Scotland.

Whether he likes it or not, the farmer under irrigation has to lose some of his freedom. He must keep step with his neighbors and irrigate when his turn comes. A kind of community organization must be adopted that the humid farmer can ignore.

The pioneer settlers of the arid region did not at once realize the profound economic changes which irrigation would enforce. They gave little thought to the institutions they must adopt. For a time they were able to work and think as individuals. By means of a simple plow furrow they turned water from streams over the thirsty soil of the low-lying bottom lands. Opportunities for this kind of development, however, were limited. Soon the bottom lands had been filed on; all the cheap ditches had been built.

Then it began to be realized that if the magic touch of water was to bring into fruition the latent agricultural wealth of this inland empire, a different and much costlier type of irrigation work had to be brought into being. Reservoirs were needed to hold back the floods; costly aqueducts had to be carried through precipitous mountain canyons. Only in this way could homes be made on the better soils of the higher plains.

These great structures cost more money than single settlers, or even organizations of settlers could provide. The cost of works soon went beyond the means of corporations. About the beginning of this century, it was realized that only the nation or the states had the credit and the reserve of resources needed to bring into existence the monumental structures required for the complete conquest of the arid region.

The reclamation act passed by Congress in 1902 was the outcome of this new and broader conception of the future of irrigation. It set aside the proceeds from the sales of public land, to which was added later one-half the money coming from mineral leases, as a fund with which to build irrigation works. This fund was to be further augmented by money received from water users in payment for irrigation works. Irrigation works were to be paid for in installments extending over twenty years, no interest being charged on deferred payments.

In its agricultural aspects, dotting the unpeopled areas with homes has brought large returns. The crops grown in 1924 on twenty-four projects were worth $66,488,560. One hundred and forty-three thousand people live on the irrigated farms and an additional 337,000 in project towns and sites. When all the farms are occupied there will be from 15,000 to 20,000 more. Reclamation has done much to save some arid states from economic collapse. The situation in Nevada would be critical if it were not for the Newlands project. Counting those who live on this project, the state has only 70,000 people. This little handful of citizens supports government, schools, courts and higher education over an area larger than the state of Illinois. Without the Newlands project farms with their winter feed for range stock, it is difficult to conceive how this state would carry on with its shrinking resources in mines and forests.

Western irrigation areas are now our main source of long staple cotton. Millions of dollars which now go to the irrigation farmers of Texas, Arizona and California would, without federal reclamation, go abroad to the cotton growers of Egypt. Without the local fodder crops of irrigated farms, the range livestock industry of the arid West would collapse. These federal projects have given an economic support to cities that sorely needed it. They have increased the business of transcontinental railroads, furnished markets for the products of factories and contributed far more to the economic strength of this country than is realized in the humid sections of the country.

These achievements justify the government's activity in reclamation, but along with them there has been a waste of money, effort and opportunity on the part of settlers, because the problems of farming and the human needs of settlers have never been adequately thought out nor plans made to meet them.

The Larger Conception of Reclamation

Congress realized at the outset that reclamation requires money and skilled engineers. These were provided. It did not realize that money and expert advice were needed to change sagebrush deserts into farms. These were not provided. It was not realized that to repay the immense cost of works, settlers must be skilled cultivators. Their selection and training were ignored.

If reclamation is to go on we should provide for these human and economic needs. Only by doing this can the monumental enterprises now being considered by the government be made a success.

The irrigation works of the Columbia Basin project in Washington will cost nearly $200,000,000. The water right for a single acre will cost $158. To that must be added the cost of changing raw land into farms, which will average $100

*An address before the Western Society of Engineers, Chicago, October 26, 1925.

an acre. The Colorado River now irrigates 2,000,000 acres. When all its waters have been conserved and used, it will irrigate 6,000,000 acres. The agricultural development of these two valleys will cost more than a billion dollars. Without skilled farmers working with good tools, owning good stock and using science and skill in cultivation, much of the money spent on construction will be thrown away. To make these costly works pay there must go with them an agricultural and rural civilization as far removed from that of the covered wagon as that of Denmark is from that of Central Africa.

To create this new rural civilization is a task worthy of our ablest minds, one of the greatest which ever challenged the ability and patriotism of this republic. Let us, therefore, follow the evolution of the last quarter of a century, in order that we may understand what has been achieved and what tasks confront us.

We Should Profit From Past Experience

To begin with, federal reclamation should be divorced from politics. Less attention should be given to local importunities. This means disappointing some states which desire the expenditure of a share of the fund within their borders. From the first, western congressmen have been subjected to strong local pressure to get works built and afterwards to relieve settlers from their payments. The high construction costs of today render it imperative that hereafter reclamation be freed from all political control.

The reclamation act was framed on the theory that, if irrigation works were built, settlers would flock in and in some way dig in and succeed as they had on the prairies of Iowa and Kansas, but the settler in Iowa could begin as a farmer, doing farm work. A paying crop could be grown the first year. The settler on a reclamation project deals with land baked for centuries. He has at least a year's work that is not agriculture but engineering. Before he can grow a crop he has to have a shelter for his family and his work team. His land has to be fenced to keep out range cattle and sheep. The inequalities of the surface have to be smoothed off so that water will flow over it evenly. This is hard and discouraging work. It requires tools that the farmer from the East has never before seen. It requires a peculiar knack and skill to do the work properly and it is often enormously expensive. The settler sees his savings eaten up doing unproductive work, and when his capital is gone, he has to succumb.

A majority of settlers on these projects did not know what crops to grow or when they should be watered. All the conditions were strange and new to them. If they could have been organized so that they could have touched elbows in preparatory development, its influence in keeping up their morale would have been invaluable. Working alone, without practical advice or direction, much that they did was done at a disadvantage.

The Problem of Collection

Heavy private indebtedness incurred in farm development has caused thousands of mortgage foreclosures. This has caused settlers to lose years of effort and has demoralized reclamation finances. The unpaid assessments for construction and operation for the five years from 1920 to 1924 total $8,500,000. This was increased in 1924 by over $3,000,000. Some of the projects during that period have paid practically everything they owed. Some had paid practically nothing. In some cases failure is due to unfit lands. No matter how hard the settler works, he cannot earn money to repay project costs. On others, a policy of drift has caused good projects to remain undeveloped, the fertile soil uncultivated.

The Lower Yellowstone project in Montana is an example of the latter type. It needs only good farmers working on small farms to make this as good an irrigation project as those around Salt Lake and Denver. Owing to the fact that a large part of the land is held by speculators who are not farmers, only one-fourth of the project land was irrigated in 1924, fifteen years after water was first supplied. Some of the unirrigated land is dry-farmed, there being enough rain to grow grain; some is still covered with native grass. If these owners had been real irrigators, desiring to farm, no compulsion to irriagte would have been needed, but under a system which opened the land to settlement to the fit and unfit on equal terms, communities were gathered together, here and elsewhere, many of whose members knew nothing of irrigation farming and never intended to become farmers.

On another project which we are trying to salvage, I recently went over the list of occupations of the early settlers. The first was a deep-sea diver, the next was the wife of an itinerant baseball player, the third had been a missionary in China. A defunct bank owned several farms. A painter, a plumber, a carpenter, all living in distant cities, owned farms, all unoccupied and untilled. A transcient trained nurse had invested her savings in one of these speculative temptations. She had neither the money nor inclination to do more. None of these people have paid water charges or delinquent county taxes for three to five years. Certain of a great agricultural community or the solvency of an irrigation project cannot be secured with this kind of human material. On projects like this the fundamental problem is to get real farmers to replace these derelicts who have givenup hope but linger on, like Micawber, waiting for something to turn up. In one neighborhood there are seventy abandoned farms and a lack of morale everywhere. If an expert practical committee had selected these settlers and they had been advised about their work, there would now be no important salvage program or possible loss to either settlers or the government. The deep-sea diver would have stuck to his element; the bank would not have failed.

Water for Irrigation Should Be Worth Its Cost

The fundamental question of all future projects should be, will the productive value of the water in irrigation be worth

These are views of the Rio Grande reclamation project in New Mexico and Texas before and after irrigation

what it costs to provide it? This is more important than it was twenty-five years ago because the costs of construction and of farm development are two or three times as great as they were then. When Congress passed the reclamation act, $25 an acre was regarded as the maximum construction cost which any settler could afford to pay. Even this figure seemed preposterous to the pioneer.

A range cattleman met a settler who had agreed to pay $10 an acre for a water right in a private ditch. He told the settler he could never do it and he might as well end his misery at once by jumping in the river and drowning himself. The cattleman looked on $10 an acre for a water right as a prohibitive price. He had built his own ditch with a plow and scraper. He had cut logs for his cabin out of the nearby forest. His pole fence had cost him nothing in money. Time and labor with him had not counted, hence going in debt $10 an acre, with payments on interest and principal, was regarded as financial folly, foredoomed to disaster.

When, however, bills for federal projects were presented to settlers, instead of $25 an acre, the costs were in some cases two or three times this sum, and in addition there was a yearly assessment for operating expenses. Out of this have grown controversies which have embittered the relation of the government and the water users for twenty years.

Land Speculation Must Be Eliminated

Another evil of reclamation not entirely foreseen and against which the original law provided in adequate safeguards, was land speculation. This has been a vampire that has done much to destroy the desirable social and economic purposes of the act. The original idea was that government works would be built to irrigate public land, and that this land would be homesteaded free of cost, developed and cultivated by actual owners. As it has turned out, the act has been largely a lifesaver for bankrupt private projects.

The first project begun was in Arizona, where on Salt River the land had been acquired by private owners who had built canals to divert the unregulated flow of the river. They found they had full canals in June and empty ones in August. Agriculture was impossible without a storage reservoir to hold back the floods and deliver water for late irrigation. These financially embarrassed projects could not build the reservoir. The government undertook it. Then it was found that the private projects could not raise money to repair and enlarge their canals so they could use the stored water. The government then acquired and enlarged the canals. Finally it was wholly a government scheme, serving land which was in private ownership when the project was authorized. Capitalists held thousands of acres of this land. Speculators rushed in and bought, at low prices, thousands of other acres.

This occurred on other projects. Attracted by misleading publicity uninformed people bought farms at inflated prices. Settlers were told they would have no trouble with water right payments and induced to invest all their capital in land. When pressed to pay the government charges, they made recurring appeals to Congress for relief.

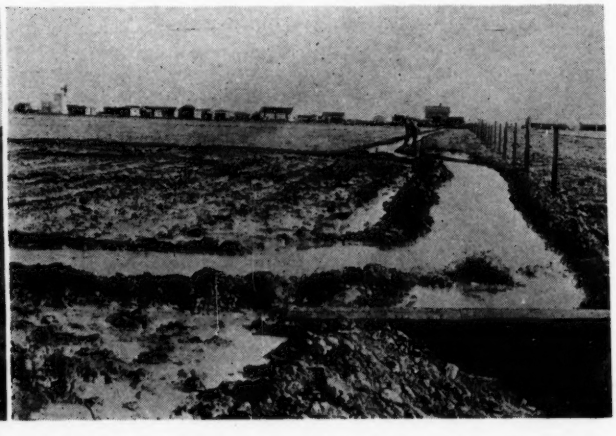
Between 1921 and 1924 three bills were passed by Congress authorizing or requiring deferment of payments. The purpose behind these moratoriums was commendable but their influence has been demoralizing. These deferments did not aid the struggling settler who had already paid his government assessments. There was no refund of his payments. The relief all went to the non-debt payer. On some projects they have created a wrong psychology. They have placed the non-debt payer in the saddle. They have caused large arrears of payments and broken down the morales of the local officials, who have been struggling against heavy odds to keep the projects solvent undertakings.

Believing that blanket moratoriums are an economic evil, I notified settlers in the spring of 1925 that hereafter relief, when extended, would be to individuals, and to them only after a showing that the delinquency was due to obstacles they were unable to overcome. That notice has caused the Reclamation Bureau to lead a strenuous life. Applications for individual relief came in this year by the thousands. They had to be examined and reported on in the field, and then scrutinized in the Washington office. In all cases the underlying idea was to give sympathetic consideration, but to insist on payments where the government's generosity was being abused. As a result of this action hundreds of thousands of dollars were collected where blanket deferment would have resulted in non-payment.

Financial Conditions on Old Projects Require Conservative Action in Starting New Ones

Financial and agricultural conditions on the older projects require that careful attention be given to all matters which will affect the solvency of new ones. The last Congress made appropriations for six new projects. Their acre-cost is far higher than that of any government works hitherto built. Estimates vary from $125 to $160 an acre. The land is unimproved. Everything needed to make a farm will have to be placed on it, and this will cost on an average about $100 an acre. The settler will, therefore, face an investment of between $225 and $260 an acre when his farm is a going concern, and the question is, will these farms be in demand by people able to develop and pay for them? Local people assure us that we need have no fear about settlers or payments. They insist that the farms will be taken and that the charges will be paid, but their judgment may be biased by their passionate desire for development.

When these appropriations were under consideration I appeared before the appropriations committee of both houses of Congress, and stated my conviction that without adequate aid and direction in farm development, none of these projects would be a success. I stated that it would require from $5,000 to $7,000 to improve and equip an 80-acre farm; that settlers with this much capital would not pioneer, because they could buy improved farms in the East or South.



(Left) Homesteading on the Umatilla reclamation project in Oregon. (Right) Irrigating with a canvas dam on the Shoshone project Wyo.

For the development of these lands we must look for settlers who have between $2,000 and $3,000, which is enough to underwrite a loan for completing farm development. If we accept them as settlers, and permit them to expend all their capital, we are bound to provide a source from which the remainder of the capital needed to complete farm development can be secured.

An excellent bill for this purpose was introduced in the House and in the Senate by Senator Kendrick and Congressman Winter. It provided for advances of money from the reclamation fund. It was my recommendation, however, that if this were done, instead of applying the law to all the projects, it should apply to only two or three, where it would be treated as an educational measure, as an experiment or demonstration, rather than a definite policy.

The outcome of the discussion in Congress was provision for state aid in settlement in appropriation legislature for four projects. On these four projects the state in which each is located is required to supervise settlement of the land and provide credit for developing farms. The state are either unable or unwilling to do this. This feature of reclamation is not new in other countries. Aid and direction in farm development are fundamentals of reclamation in India, Italy, Australia and South Africa. It will be advanced by being decentralized; by taking it away from the federal government. It is, morever, a proper function of the state, but unless it is provided by the states or some other agency the building of canals should cease.

Recent regulation of the Secretary of the Interior provide that settlers on public land must have a capital of $2,000, and have had at least two years' experience. This is the first time in the nation's history that qualifications for settlement have been required. The required qualifications of industry, experience, character, and capital are indispensable to success, if we are to build costly works. The inexperienced, and those without money, would fail; and, in the end, the loss would fall on the government.

Fairness to the settler, and to the scheme, requires that whoever undertakes to subdue the desert and bear the burden of its costs should be fitted for the task. If reclamation is to be the chief instrument in building up rural civilization in the western third of our country, it must provide real opportunities for home-makers, give them a lifetime in which to develop and pay for farms, and have efficiency and integrity as the watchwards in all relations between the water-user and the government.

The Durham State Land Settlement as an Object Lesson in Agricultural Engineering

By David Weeks

Mem. A.S.A.E. Associate, Division of Rural Institutions, University of California

THE Durham State Land Settlement* is a rural community of about one hundred forty families organized as a demonstration under the California Land Settlement Act of 1917. This Act was passed by the California legislature following the report of a commission appointed to investigate colonization and rural credits in California. The development of agriculture under irrigation has been found to have different requirements than were necessary in the development of the Middle West under the Homestead Act. Conditions have changed. Our public agricultural lands have largely been brought into private ownership. The carrying charge due to reclamation development, the increase in the purchase price of raw land, increased taxes, and the continually mounting cost of commodities purchased by farmers require that the irrigated farm and the irrigation district be brought to a point of maximum economic production as soon as possible.

There has been an agricultural depression. Sentiment against agricultural expansion and development has been reflected in opposition to plans for improving rural social and economic conditions by the introduction of planned rural development. Once an irrigation project is created, however, it becomes necessary to provide means of rapidly building up agriculture which is efficient and which is attractive, otherwise too large a burden will fall upon the lands of the district which have been developed while the undeveloped lands are likely to be confiscated by the carrying charge.

Elaborate provision has been made for financing the construction of irrigation works, but so far neither financial means nor professional services have been available in the planning and building of agriculture under irrigation. This planning and building of agriculture is primarily an agricultural engineering job previously overlooked by those in charge of reclamation development and by agricultural engineers themselves. The institution which will gear the agricultural engineering profession to the job of building rural communities in reclamation projects deserves the serious thoughts of all types of agricultural engineers.

Durham is an illustration of what such an institution would accomplish. The outstanding features are the scientific subdivision based upon careful contour surveys, soil analyses, and irrigation design; selection of settlers on the basis of ability and experience; scientific planning of buildings and farmstead layouts by farmstead engineers; low interest rates; a low first payment on land purchased; long term amortized payments on the deferred balance of land costs; long term credit facilities for construction of buildings and general improvements; short-term chattel loans for the purchase of livestock and equipment; expert advice on engineering, agricultural and business problems of the farmer; a community park and a community hall for social and business gatherings; cooperative purchase and sale of farm products; high-grade dairy stock; cooperative cooling plant; cooperative cold storage plant; cooperative distribution of irrigation water, and many other interesting features made possible through community organization.

*(Note: The annual meeting of the American Society of Agricultural Engineers in California in 1926 will offer an opportunity for the members of this Society to visit the Durham State Land Settlement.)

The older engineering professions during the years of their existence have created institutions in the form of municipal ordinances, reclamation districts, corporation laws, and various other legal relations and organizations by the means of which their members have been able to render service to society. Agricultural engineers must recognize importance of the fostering of agricultural engineering institutions to insure the rapid growth of the profession.—David Weeks

The Problem of Common Storage for Eastern Apple Growers*

By J. L. Strahan

Mem. A.S.A.E. Assistant Professor of Agricultural Engineering, Massachusetts Agricultural College

FOR many years apple growers have been using house and barn cellars and specially designed storage houses for keeping certain commercially important varieties of apples off the market, until such time as they could be disposed of to greater advantage than is usually possible at picking time. The so-called common storage method in the East has been practiced from Main to North Carolina and from the Atlantic coast to Ohio. In fact, it constitutes one of the large marketing problems wherever apples are grown commercially in this section of the country. In some of the areas of heavy production, as in eastern Massachusetts, growers are today building common storage houses to take care of upwards of 10,000 bushels. When some of our younger orchards come into bearing, these will have to be considerably enlarged.

The problem of common apple storage is becoming increasingly more important. Answers to one of the questions included in a recently circulated questionaire indicate that an enormous quantity of apples are held in common storage in the various commercial fruit growing sections of the East. The percentage of stored apples held in common storage as against those held in refrigerated storage are as follows by states:

Maine	30	Pennsylvania	80	
New Hampshire	20	New Jersey	30	
Vermont	30	Kentucky	25	
Massachusetts	25	Viriginia	5	
Connecticut	45	West Virginia	40	(probably)
New York	3	North Carolina	50	
Ohio	75	Tennessee	15	

These figures are not based on detailed surveys but may be considered as indicative of the probable scope of the storage problem at the present time. If they are correlated with the 1920 census crop reports on the assumption that ½ the crop is marketed immediately and ½ stored, they represent a total of very nearly six and one-half million bushels.

Data on Baldwin prices at harvest and during the storage season on the Boston market for the past twelve years show an annual average price difference of 43 cents per bushel. In other words, the average annual price at harvest was $1.21 and the average annual price for storage apples was $1.64. If these values relating to market trends in Boston are at all indicative of conditions in other large centers, then the successful operation of common storage houses throughout the east generally would result in a net saving to the growers of upwards of two and three quarter millions of dollars annually.

The question might arise as to whether an individual can afford to own and operate a common storage plant when cost of construction and capital investment are considered. The following figures tell the story in the case of N. A. Nulst, of South Amherst, Massachusetts. He built a bank storage cellar with concrete walls and frame roof. It is 40 by 70 feet over all, 12 feet being used as a packing room and 56 feet for storage. It is ceiled at a height of 8 feet. This storage has a capacity of 7,000 bushels and was built at a cost of $3,891.94, or 55.6 cents per bushel capacity.

Estimating the probable life of this building at 20 years and assuming the carrying charges and investment interest at 14 per cent the cost of owning it for the period mentioned will be $1.557 per bushel capacity.

Assuming that there will be eight capacity crops in 20 years, and assuming further that there will be a maximum rate of shrinkage in storage of 10 per cent, the number of bushels per bushel capacity of the house packed out in 20 years will be 7.2. On the basis of the Boston price average for the past 12 years, this will result in a gross profit of (7.2 x 1.64)—(8 x 1.21), $2.13 per bushel capacity. Deducting from this the cost of ownership per bushel it leaves him a net profit of (2.540—1.556), or 5 .4 cents per bushel capacity in 20 years. Per year this would amount to 2.87 cents equivalent to an annual profit of $200.90.

Where the cost per bushel can be reduced, obviously the profits will show an increase. E. F. Shumway, of Belchertown, Massachusetts, roofed over an old cellar hole and converted it into a storage housing 3500 bushels at a cost of only 18.5 cents per bushel. On the same basis of figuring as above, the annual profit per bushel capacity is 8.13 cents. Seven other houses of which we have the construction costs averaged 22 cents per bushel capacity. This will show an annual per-bushel profit on the average of 7.57 cents. We feel that it will be a sound investment to spend as high at 65 cents per bushel capacity for the building. This would result in a profit to the grower of 1.5 cents per bushel capacity.

Apparently, considering the interests of the industry as a whole, the consuming public and the individual growers, this problem of common storage is a large one and one which is well worth the time and cooperative efforts of pomologists and agricultural engineers looking towards its solution.

Engineers and Horticulturists Should Cooperate

Up to the present most of the work has been done by the horticulturists, principally by Cole in Massachusetts, Anthony in Pennsylvania, and Hutt in North Carolina. Although there is perhaps some difference of opinion regarding the proper condition for storage, most of the horticulturists are agreed about as follows:

Apples keep best in storage at temperatures ranging between 32 and 40 degrees Fahrenheit and at comparatively high relative humidity percentages. A relative humidity as high as 96 per cent has been recorded in storage experiments conducted in Vermont 10 years ago, while from 80 to 85 per cent appears to be optimum. It should be noted that uniformity of temperature and humidity is a very important consideration. Wide fluctuations in temperature especially during the early storage season are to be avoided. Another very important factor contributing to successful storage is the rapid cooling of the fruit to a low point as soon as it is picked. It is probable that immediate cooling to the optimum storage temperature will lengthen the practical holding season from one to four weeks and in some instances even more.

If it is the function of the horticulturist to determine and state the conditions under which apples can be successfully stored, it is for the agricultural engineer to devise means for producing and maintaining these conditions. Very close approximations to satisfactory design have been made by growers using a cut-and-try method, and in many instances good results have been obtained in their houses. Much remains to be done, however, before complete control of conditions is obtained. Just what constitutes adequate ventilation under different conditions, how best to control relative humidity, and particularly and above all how to manage the problem of rapid cooling early in the season are all questions which will bear considerable investigation.

Geographical Extent of the Problem

In the northern New England states, namely Maine, Vermont, and New Hampshire, the problem of temperature control is not so very difficult. I have reports from Maine and

*Paper presented at a meeting of the North Atlantic Section of the American Society of Agricultural Engineers, Cornell University, Ithaca, New York, April, 1925.

New Hampshire of the successful storage until February of such early varieties as Macintosh, Wealthy, Gravenstein, Waggener and Jonathan. Later varieties, as Baldwins, Spy, Ben Davis, Stark, Rome, etc., keep well through April, and one grower reports keeping Russett and Ben Davis until August. It is possible in this region to bring the temperature of the storage room down to 40 to 45 degrees quite early in the season as the nights cool off rapidly. Farther south, however, this control is not so certain. Some seasons adequate storage temperatures can be attained early enough to store successfully Wealthy and Macintosh. Probably seven seasons out of ten, however, the early fall temperatures will fluctuate so that some artificial cooling is desirable if best results are to be obtained. This is true throughout all of the central and southern New England and becomes increasingly more of a problem in New York, New Jersey and Pennsylvania. In these and still more southerly climates only the later winter varieties can be kept satisfactorily. Still farther south, in the Carolinas, the winter climate in the mountain sections closely approximates that of the northern states and very fair results have been obtained with air-cooled houses with such varieties as Mammoth Blacktwig, Delicious, Stayman, Ben Davis and Red Limbertwig.

Farther south than this there is no problem as the commercial apple industry is negligible in extent, and what apples are grown for the market are shipped immediately.

From the foregoing it appears that there is a geographical aspect to the storage problem which in conjunction with the market demands of particular localities will affect storage practice and the design of houses. Dividing the eastern seaboard roughly into three areas we find early varieties quite easily handled in the northern section, consisting of Maine, northern New Hampshire, and Vermont, while in the central section, that is, southern New England, New York, New Jersey, and Pennsylvania, early varieties are successfully stored only in those instances where precooling is practiced, or where the storage is iced*; and farther south than this only late varieties are held in storage to any large extent.

In Massachusetts, in the central area, our market calls principally for Macintosh, Delicious, Wealthy and Waggener for the holiday trade. This means ordinarily that these varieties must be held in refrigerated storage until on or about the first of the year. But this kind of storage is proving expensive (15 cents per bushel the first month; 10 cents the succeeding months, and 5 months cost 56 cents).

Our problem therefore is to develop a common storage which will provide means for reducing the temperature of the crop immediately after it is picked and also means for holding it at the proper temperature until such time as it is to be packed out for market. Occasionally these varieties are kept in common storage, the practice at the present time being to allow one day's pick to remain out over night subjected to the night temperature and to place it in a properly insulated and ventilated storage the first thing in the morning. This is, in effect, precooling. At present no figures or data are available, but our experience indicates that probably 350 to 400 bushels of apples precooled in this way over night out-of-doors could be placed in a room with a capacity of 3000 or 4000 bushels in which the temperature had been reduced to 40 degrees by ventilation, or by other means without affecting the room temperature over 4 or 5 degrees. But the difficulty has been to get the temperature of the storage room down during the Macintosh picking season.

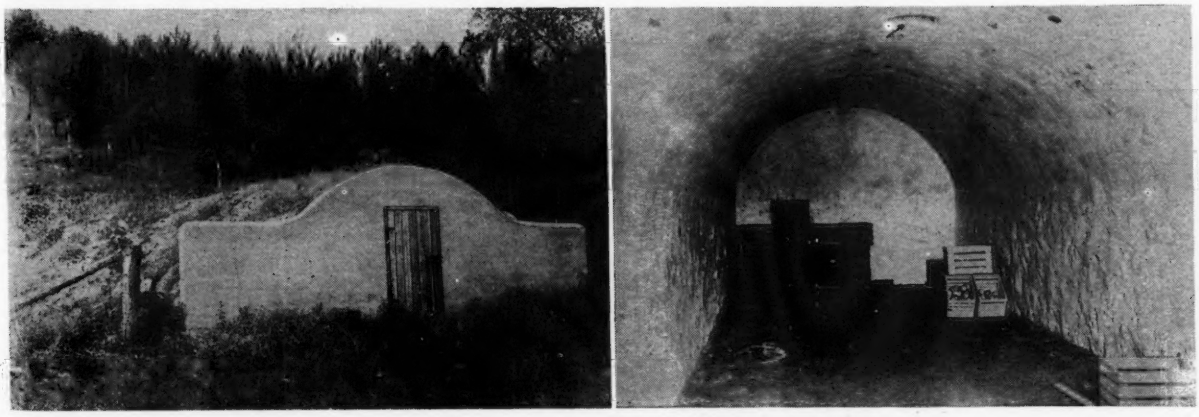
Figures just received from the Pennsylvania Agricultural experiment station seem to indicate that the practice of using ice to cool off underground cellars will not be successful, unless the cellars are insulated from earth temperatures. Data were obtained from bank storages that show a very marked effect of ground heat on the storage temperature. Apparently ventilation alone will vary the temperature in the storage room only from 8 to 10 degrees above or below ground temperature. R. D. Anthony in this work reports that either vary warm air up to 80 degrees or very cold air down to 10 degrees has for several hours been passed through a cellar in which the ground temperature ranges between 45 to 50 degrees without modifying the room temperature more than from 4 to 10 degrees. These figures are based on thermometric data obtained in a cellar ventilated by means of either door and window openings or by a fan system operating through underground tile inlets and outtake flues from the ceiling through to the roof. If ground temperature ranges around 50 degrees in early fall, then according to Anthony it is doubtful whether by proper manipulation of a ventilation system we shall be able to maintain a storage temperature as low as 40 degrees unless insulation against soil temperature is provided. It thus remains to be determined whether ice in storage cellars will be successful in controlling temperatures.

F. H. Morse, of Waterford, Maine, has operated two storage houses for 20 years, one of which is a cellar and the other above ground. Speaking of the former, he says "From our present knowledge and experience, we think the house built entirely above ground is better than a cellar, where, when you wish to cool it off, you have to overcome the warmth held by the soil, rocks, cement, or whatever it is made of." This opinion, based on more or less casual observation, seems to check with Anthony's findings.

The effect of soil temperature in maintaining uniform thermal conditions in an underground room is undoubtedly very great, and it will be of much value to determine more accurately than has been done up to the present just what this effect is and what means must be taken to control it. As a general thing the cellar storage is less expensive to build than one above ground, and is better protected against freezing in the winter. For storing late varieties it is undoubtedly the better type. But unless some method can be evolved for holding a low temperature early in the season, it cannot successfully be used for storing such varieties as Macintosh, Wealthy, Gravenstein, etc. In Massachusetts we are planning some experiments in ice cooling cellars this

(Continued on page 270)

*Orchard cooling for Waggeners.



Exterior and interior views of a modern cellar for the common storage of apples

A Preliminary Study of the Transverse Strength of Structural Bamboo

By A. L. Teodoro

Assoc. Mem. A.S.A.E. Assistant Professor of Agricultural Engineering, College of Agriculture, University of the Philippines

WHEREVER bamboo grows it is used extensively in the construction of houses and of various implements. In agricultural districts in the Philippines it is the most commonly used structural material.

No published data is available concerning the transverse strength of bamboo. This paper gives the results of some preliminary tests made on two varieties of structural bamboo which were cured for thirty, for sixty, and for ninety days both in the sun and in the shade.

Two curing periods were run. The dry season period comprised the months of April, May, and June, and the wet season period comprised the months of September and November.

Materials and Methods

Varieties Used. The varieties used were thorny bamboo (Bambusa spinosa) and thornless bamboo (Bambusa vulgaris). These two varieties represent the most common structural material for temporary houses and bridges in the Philippines.

Procedure. Fifty mature canes of Bambusa spinosa and fifty mature canes of Bambusa vulgaris were used during each season test. Soon after the canes were cut, they were hauled to their curing places. The number of canes in each variety was divided into two equal parts. One-half the number of poles of each variety was placed in the shade, and the other halves were left exposed to the sun.

Two racks, each about 2 meters (6.56 feet) wide and 1 meter (3.28 feet) high were made. The bamboo poles were piled on these racks. One of the racks was located under a large tree that gave a dense shade. After the poles were piled on this rack several coconut leaves were put over them. The other rack was placed where the poles were directly exposed to the sun.

Eight bamboo canes of each variety were selected at random from each pile for each test made. Each cane was divided into two or three sections, each of which was 3.40 meters (11.15 feet) long. The canes were lettered as they were cut and the sections numbered A-1, when butt; A-2, when middle; and A-3, when tip.

Prior to testing, the outside and the inside diameters at both ends of each section were carefully measured. The weight of each section was also recorded.

Method Adopted for the Transverse Test. The platform scale and levers were arranged as shown in the diagram (Fig. 1). A V-shaped block "a" was placed right on the center of the platform scale. Another block "b" was placed at a distance of 2.74 meters (9 feet) from "a." On these blocks rested and I-beam of iron. On the beam 30.48 centimeters (1 foot) from the block "b" was placed another block "c." At a distance of 3 meters (9.84 feet) from this last block, perpendicular to the beam was the jack screw. Still another block "d" similar to the block "c" was placed on the jack screw. On these last two blocks rested channeled rectangular blocks "rb," the lower surfaces of which were covered with iron. This gave sufficient strength to the blocks. All the edges of the blocks were covered with iron of about 0.63 centimeters (¼ inch) thick. The edges of the first two blocks were made parallel also those of the other two blocks. The two pairs were perpendicular to each other.

The sections of the specimen rested on the channeled blocks. The height of the block on the jack screw was in its lowest position. An iron strap, "B," as shown in Fig. 1, was used to supply the mechanical load. Another channeled block "Z" was placed on the section between it and the belt. The

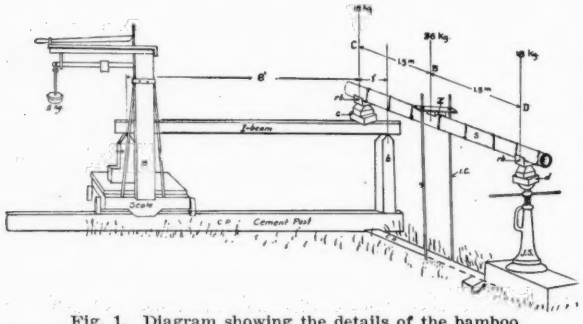


Fig. 1. Diagram showing the details of the bamboo testing apparatus

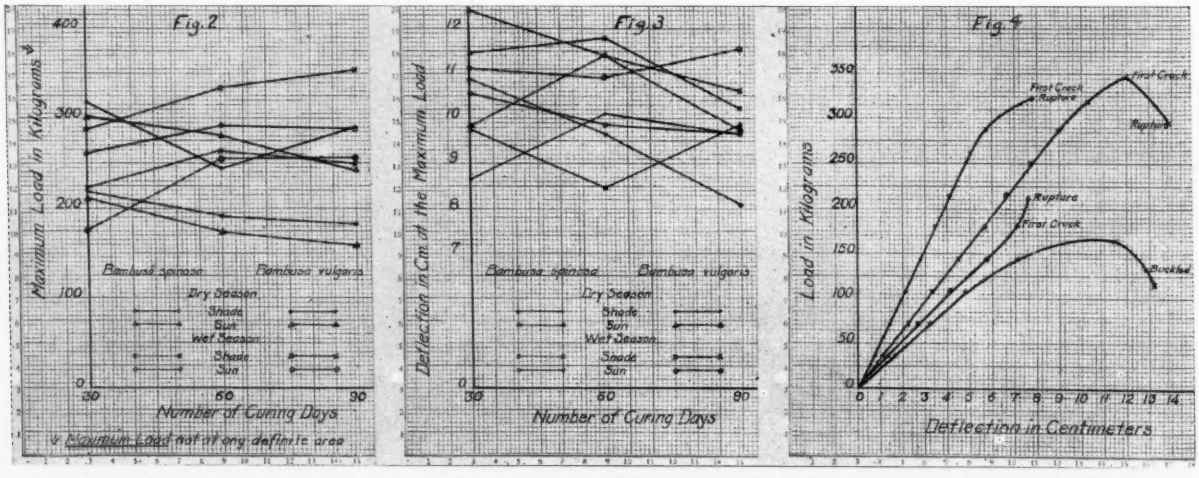


Fig. 2. (left) Relation between the maximum load and the number of curing days. Fig. 3. (center) Relation between the total deflection at maximum load and the number of curing days. Fig. 4. (right) Relation between the load and the deflection

purpose of this was to distribute the load over the upper surface of the section.

The method of conducting the test was simple. The readings of the scale beam and measurements of deflections were taken at each change of load, the change of load being made by raising the jack screw. The increase in load was uniform until the elastic limit was reached. For convenience of readings, a uniform increment of 36 kilograms (79.2 pounds) was used; that is, a reading was taken each time the load became 36 kilograms greater than at the preceding one. At each change of load, sufficient time was allowed to elapse, so that the motion had ceased.

The jack screw was turned slowly until the desired load was registered by the balance. In this manner the elastic limit may be easily determined. The loading was then continued until the point of rupture was reached. No shocks nor jerks were made.

A total of from fifteen to eighteen sections from each variety were tested for each method used. The average time required for testing a section was about fifteen minutes.

TABLE I. Result of Bambusa Spinosa Test During the Dry Season

Periods of curing		Av. wt. of canes	Av. outer diameter	Av. inner diameter	Av. thickness	Av. max. load	Total av. deflection at max. load	Av. load at rupture	Total deflection at rupture
		kg.	cm.	cm.	cm.	kg.	cm.	kg.	cm.
30 days curing	Shade	7.33	8.17	6.34	0.91	318.21	8.63	206.03	11.55
	Sun	6.50	7.82	6.07	0.87	300.30	9.76	201.50	11.65
60 days curing	Shade	6.34	7.83	6.30	0.76	244.00	10.10	183.42	11.54
	Sun	5.84	8.55	6.94	0.80	282.70	8.45	226.41	9.92
90 days curing	Shade	6.06	8.42	6.37	1.02	291.60	9.65	232.60	10.74
	Sun	6.00	7.90	6.06	0.92	244.67	9.85	207.47	11.60

TABLE II. Result of Bambusa spinosa test during the wet season

Periods of curing		Av. wt. of canes	Av. outer diameter	Av. inner diameter	Av. thickness	Av. max. load	Total av. deflection at max. load	Av. load at rupture	Total deflection at rupture
		kg.	cm.	cm.	cm.	kg.	cm.	kg.	cm.
30 days curing	Shade	6.60	7.73	6.26	0.83	283.07	11.45	259.39	10.95
	Sun	5.90	7.58	5.99	0.79	261.60	10.55	213.50	8.01
60 days curing	Shade	7.30	7.77	6.09	0.84	333.10	11.80	331.10	11.80
	Sun	6.50	7.90	6.45	0.73	219.45	9.85	272.33	9.87
90 days curing	Shade	6.74	8.00	6.20	0.90	354.00	10.20	349.05	10.25
	Sun	5.90	7.61	5.98	0.81	287.00	9.65	286.95	9.65

TABLE III. Result of Bambusa vulgaris test during the dry season

Periods of curing		Av. wt. of canes	Av. outer diameter	Av. inner diameter	Av. thickness	Av. max. load	Total av. deflection at max. load	Av. load at rupture	Total deflection at rupture
		kg.	cm.	cm.	cm.	kg.	cm.	kg.	cm.
30 days curing	Shade	6.56	6.86	5.05	0.90	218.16	10.87	132.12	13.12
	Sun	5.57	7.10	5.50	0.80	211.76	9.80	184.75	10.35
60 days curing	Shade	5.76	7.51	5.90	0.80	191.11	9.65	190.80	10.10
	Sun	4.69	6.80	5.30	0.75	174.30	11.40	132.15	12.80
90 days curing	Shade	5.50	6.92	5.47	0.72	183.08	8.10	180.50	8.12
	Sun	4.40	6.42	4.80	0.81	159.96	9.75	132.50	11.95

TABLE IV. Results of Bambusa vulgaris test during the wet season

Periods of curing		Av. wt. of canes	Av. outer diameter	Av. inner diameter	Av. thickness	Av. max. load	Total av. deflection at max. load	Av. load at rupture	Total deflection at rupture
		kg.	cm.	cm.	cm.	kg.	cm.	kg.	cm.
30 days curing	Shade	7.00	6.90	5.10	0.90	223.63	12.40	Buckled	
	Sun	5.48	6.75	5.14	0.80	175.80	11.10	182.80	10.95
60 days curing	Shade	6.80	7.50	5.90	0.80	267.75	11.40	249.30	11.42
	Sun	6.75	8.03	6.30	0.86	255.00	10.90	207.20	11.30
90 days curing	Shade	6.40	7.40	5.95	0.72	249.90	10.60	256.90	10.20
	Sun	5.40	7.06	5.50	0.78	256.05	11.55	230.80	11.80

Experiments and Results. The results of these experiments are shown in Tables I, II, III, and IV, and are plotted in Figs. 2, 3, 4.

Discussion of Results. In studying Tables I, II, III, IV, and Figure 2, we have a comparison of the average maximum loads of the different poles tested under different conditions. Fig. 2 shows that, in general, the thorny bamboo has greater transverse strength than the thornless bamboo. This result would seem to prove that the thorny bamboo is a stronger structural material than the thornless bamboo.

In the graphs in Fig. 3 is given the average deflections with the corresponding average maximum load. Here will be noted that the thornless bamboo has, in general, greater maximum deflection than the thorny bamboo. This deflection was observed to vary from 1 to 2 centimeters in thorny bamboo and from 1.5 to 3 centimeters in thornless bamboo.

The results of all tests show that more force is needed to break transversely a large and thick pole than a small thin one, that is, when the poles were cured under the same conditions. They also seem to show that the time of curing must be shorter in the dry season to obtain the best result in transverse strength.

A plot showing the behavior of some typical specimens during the test is shown in Fig. 4. The graphs clearly indicate that the stress and the strain up to the elastic limit are fairly proportional. The yield point in some of the specimens was clearly illustrated.

Summary and Conclusions. These comparisons show that the thorny bamboo (Bambusa spinosa) is stronger transversely than the thornless bamboo (Bambusa vulgaris). The canes in each variety tested have a fairly perfect elasticity curve. The average transverse strengths of thorny bamboo and thornless bamboo under these tests, are about 280 kilograms (616 pounds) and 210 kilograms (462 pounds), respectively. The average deflection per every 36 kilograms load is from 1 to 2 centimeters in thorny bamboo and from 1.5 to 3 centimeters in thornless bamboo.

The writer believes that, on account of the great variability in the size, weight, and thickness of the poles tested, together with the uncertainty of the age of the canes, no definite conclusion can be formulated in this series of tests. The number of nodes and internodes which undoubtedly have an effect on the strength and the deflection of the canes, was not taken into consideration. Effects of other factors, such as insect injury, moisture content, growth of mushrooms, and weather conditions, were not taken into account.

Fire Protection

FIRE prevention may be economically built into the farmstead by the proper arrangement of buildings so that a fire in one of them does not necessarily doom all to destruction. Scrap material, such as might otherwise be used for kindling may well be used as fire stopping, a cheap and effective preventive measure. The problem of fire prevention is concerned as well with buildings now existing. In these buildings we have the necessity of eliminating the defective flue, combustible roof, faulty wiring, and the careless storage of oils and combustibles.

While this is a new field to agricultural engineers it is one well worthy of our best endeavors. Shall we then aid the farmers in obtaining increased efficiency in production with no attention paid to increased protection?

The problem of fire protection on the farm is essentially an agricultural engineering problem, and because of its importance more attention should be given to it in the future than it has had in the past. Agricultural engineers are realizing this fact and are beginning to devote constructive effort to it.

European Observations of an Agricultural Engineer*

By Daniels Scoates

Mem. A.S.A.E. Professor of Agricultural Engineering, A. & M. College of Texas

LAST summer I had the opportunity of visiting six countries of Europe and study at first hand their agriculture. These countries included England, Holland, Denmark, Germany, Switzerland and France. In most cases I was with a representative of the government of the country we were visiting, as well as a representative of the U.S. Department of Agriculture, and thus I had an unusual opportunity to make the most of my time and see the things in which I was most interested.

Farm Structures. The first thing that impressed me relative to the farm building of Europe was their stability. Almost universally masonry construction is used, with the exception of Denmark and Switzerland where lumber is cheaper and easily obtained. Here I found a few wooden structures. They build for permanence and many of the buildings have been standing for a good many years. They also build well architecturally. Particularly did this impress me in England. Their buildings had very excellent lines.

They also believe in landscaping around the buildings, which of course, adds to their attractiveness. The farm homes were always attractive, even the laborers' cottages. They were well kept inside as well as outside and, as a general rule, very well furnished. Every home seemed to have a flower garden and a garden where the family could take tea in the afternoon. The word "garden" is generally used to mean a green lawn surrounded by flowers and shrubs.

Another thing that impressed me is that in remodelling their farm homes, they were very handy at adapting the old to the new. For example, I saw electric lights placed in the old kerosene lamp fixtures in farm homes, which were very beautiful. I found a good many farm homes in Europe that had electric lights.

The barns in England, are as a rule one-story structures built of masonry having a tile or thatched roof, sometimes both. The barnyard is usually covered with gravel and in some places paved with concrete or large blocks of stone. In many cases the keeper of the barnyard has his home as a part of the stables. In some cases the stables are all connected, while I found all over Europe examples of the house and barn being connected, although it is not a universal practice. In some cases I found the barn was just connected and in others that they were all built together in one large structure.

For example, in Switzerland I visited one farmer who had a very large building. The home occupied about one-third of the first floor of this building. The rest of the lower story was taken up with the stables. The entire upstairs of the building was given over to a hayloft. This farmer was considered a very substantial one. He also had a unique bee house, a small one-story building with a room in the center and the walls on the outside divided into compartments, allowing the bees and honey to be taken out from the inside of the building.

In the Friesian part of Holland, dairy farmers almost universally have their dairy barns and homes connected; in fact, it is just one large building, the farm home being a two-story structure at the front and the dairy barn a part of this structure to the rear. During the winter the cows are kept in these barns all the time; they are never let out. But during the summer the reverse is true. They are put into the pastures and milked and cared for there, never being brought into the barn. In fact, during the summer the barns are cleaned and scrubbed out, and sand placed in the stalls and carpets along the alleyways. The family then use the barn this part of the year for household purposes. Additional summer farm labor have their sleeping quarters here, and the farm wife does a great deal of her cooking in the barn. These barns, in most cases, have concrete floors or are paved with large stones. They have masonry troughs and in many cases I found American stall equipment being used.

The mayor of a small town in Holland, who had agricultural interests, took a great deal of pride in showing us a new farm tool he had just added to his barn. It consisted of a hay fork and carrier that put hay in to his barn loft which was in the second story of his residence.

Farm Machinery. Europe uses a great deal of American-made farm machinery and the European farmer likes it. As far as I was able to judge, wherever he had a choice and the American machine would do the work satisfactorily, he selected the American-made goods. However, there are some American machines which he cannot use because they do not handle his product in the way he wants it handled; the thresher is an example. We are not very much interested in the straw after the grain is threshed; hence, our threshers tear up the straw and make it into chaff. The European farmer wants his straw to come out like he puts it in. Hence, I did not see any American-made threshers being used in Europe; they are using English and German makes that do not tear up the straw.

They are not particularly interested in riding tools; in fact, during my entire trip I did not see a riding plow. Labor is cheap and they have more than they really know what to do with, so they are not interested in labor-saving machines. I found only the richest and most productive land using the most modern machinery. For example, I found, particularly in Bavaria, the cradle being used a great deal; in fact, the binder was a rare thing. While on the bottom land of Holland, particularly in Haarlem Lake, where they were growing crops such as caraway and mustard seed, which yielded considerable income, they were using the binder as well as other machines of that type.

In England I had an opportunity to see a farm machinery display at the Royal Stock Show and to compare English-made farm machinery with the American goods. My impression was that the English machines had most excellent workmanship but poor design. I had an opportunity at a fair in Denmark to compare German-made goods with American goods. Here I found particularly the Krupp machines. When I compared their binder with the International Harvester Company's binder I could not see a great deal of difference except in the paint. The Danes told me that the German machines were considerable cheaper but they preferred American goods because they were better goods. The materials in the German implements were not what they should be and would not stand up. I found that the Danes were using the English threshers in preference to the German threshers. They were doing all this even though the rate of exchange in English and American money was against them. This would allow them to buy much cheaper from Germany and in addition to this the Germans had added an inducement by reducing their prices thirty per cent.

The labor situation relative to farm machinery was most forcibly demonstrated to me in Halle, Germany, where I saw one of the latest German drills that had been placed on the market. It did not have any seat and required three people to operate it—one person to drive, one to steer (these two being men), and a woman following to keep the hoes clean.

Farm Power. About all the types of farm power used in America are used in Europe. I found, for instance, the windmill was used not only to pump water but also to grind feed.

*Address before the 19th annual meeting of the American Society of Agricultural Engineers, at Madison, Wis., June, 1925.

Where they are used for this purpose, of course, they are very large units (Dutch windmills) and generate considerable power. They are also very crude affairs from a mechanical standpoint.

The horse is, perhaps, the most universal source of farm power, and as a general rule is a pretty good animal. There are some places, particularly in Holland where they use one horse a great deal, while the American farmer thinks he has to have a team. In England they hitched their horses tandem.

The ox is used, particularly throughout Germany, as a source of power on the farm. For hauling light loads dogs, as well as women, were used a great deal on the continent. Sometimes they were both hitched up togther.

The tractor is not used to any great extent in Europe although I found it on a number of farms, but in most cases it was some farmer who was very well to do, as he used it for threshing more than he did to plow. Baron Von Hermann, at Munchen, Germany, had a Caterpillar tractor which he used with a five-bottom plow. He was plowing in a gravelly soil that was very thin. The plows seemed to push the soil over rather than turn it, and they did not scour well. He also had a team of mules, the only ones I saw in Europe. At the Halle Experiment Station I saw a new type of tractor plow they are experimenting with, and with excellent results. It has a drum on the rear which is used to pulverize the soil. Prof. Rudolph who had charge of the work had a great many good things to say about this tractor plow.

Electricity Applied to Agriculture. Europe is fast taking up electricity as a power for farm use. They are making a very serious study of the possibilities of its use in their agriculture. Switzerland is perhaps more serious about it than any other country, due to the fact that it has no coal deposits but does have a large amount of water power. They have gone quite a way on the electrification of their railways, and in a comparatively short time they will have all their railroads in that condition. I found that electric power could be bought for one-half cent per kilowatt-hour, while for cooking it was one cent per kilowatt-hour and for lights two cents. Farmers are using it not only around their homes but for power such as threshing. I found one creamery that was using electricity to generate steam in their boilers, and they got their electricity for two-fifths cent per kilowatt-hour. I understand that Sweden has done a great deal along this line. Some of the Danish farmers are getting their electricity from Sweden, and it was costing them 40 ore per kilowatt-hour for power and 55 ore per kilowatt-hour for lights.

I visited Borlase Matthew's electric farm, "Greater Felcourt," at East Grinstead, England. This farm has been written up considerably, and it is claimed they have done considerable research work along the line of the application of electricity to agriculture. It seems to me that the outstanding thing that was being done there was the drying of hay. Unfortunately, while I was in England the weather was fair and it was not necessary to use this method. Hence, I did not get an opportunity to see it work. They were also using an electric milking machine which was out of order and not in operation the day I was there. The dairy barn was not a model by any means. They were using electricity around the poultry house about the same as many farmers and experiment stations in this country are using it. They were just installing an electric culture plant but it was not, as yet, complete, and I did not get an opportunity to see it. I saw nothing there which looked as if it was outstanding or merited the wide publicity it got.

At Rothamstead I had an opportunity ot talk to Assistant Director Keene, as well as Mr. Haines, relative to the work they had done in applying electricity to the moldboard of the plow. This seems to be a very interesting piece of work. They have a publication out on it which, I am sure, anyone interested in can obtain. They are also doing some work relative to electro culture. Dr. V. H. Blackburn, Imperial College, London, has done more with this latter piece of experimental work than anyone else. I visited Prof. Blackburn's laboratory and found him absent. I talked to his assistant, Mr. Shaw, who showed me the plants they were growing in the laboratory. These plants were getting an intermittent discharge of electric current of 15,000 volts which was stepped up through a transformer and put through tubes to assure current of one direction. They measured the amount of electric current which the plants were getting by means of silver wires in the bottom of the pots. What they are primarily concerned with now is to find out by means of laboratory tests what the electric current does to the plants and what amount of electricity gives the best results. They are doing some work in cooperation with Rothamstead Experiment Station on a large scale, but do not expect to continue it until they know more than they do now about the effect of electric current on the plant.

Automobiles and Trucks. The automobile and farm tractor is not used as much in Europe as in America. The reason for this, I think, is the high taxes. I find in England that the yearly tax on an automobile is about $5 per horsepower. This has tended to eliminate the American brands of automobiles. The English manufacturers have been developing a lighter automobile with an engine of small horsepower, which will cut down on the tax. This automobile is not expected to take every hill on high, for they think nothing of slipping into intermediate or low gear in order to make a grade. They also run with their tops down in fair weather.

Besides the tax objection to American makes there is also their high fuel consumption and as gas is more expensive there than here, this is a matter of some importance. There are, however, a great many American cars in Europe. I find that, in England especially, the heavy trucks use steam power. That is, trucks that carry heavy loads, such as beer wagons, were operated by steam; coal is cheaper than gas. They seem to get along very well especially around London.

Irrigation. I saw very little irrigation in the countries in which I visited. In Southern England there was some used on the pastures, but it did not amount to very much. I found, however, that in all countries they were irrigating with liquid manure. The one thing the European farmer has learned is to conserve his soil fertility. This lesson is a most vital one, and the American farmer is never going to reach his greatest usefulness until he has learned to conserve his soil fertility.

Drainage. Europe has done some wonderful work along drainage lines. I had an opportunity to visit the Fens at Spaulding, England, and look over what they call "Little Holland." I found this a very prosperous part of England. The farmers were growing very fine crop. They have large open ditches which carry the water to a certain point where it is pumped out into another canal that carries it to the ocean. The centrifugal pump was used and it was operated by Diessel engines. I found, however, that before this modern equipment had been installed two beam engines with large paddle wheel pumps had been doing the job since 1825, and were still in condition to work satisfactorily if occasion demanded. This seemed to me to be a very fine tribute to the mechanical ability of the engines of that date. The canals are kept in first-class condition. The grass that grows on the canal banks, or "herbage" as it is called, is auctioned off each year. Sold to the highest bidder. In some instances the money derived from the sale of this herbage is sufficient to operate the district.

Most of this land is tile drained. The tiles are placed 66 feet apart and 3 or 4 feet deep, and the laterals are of three-inch tile. I noted the absence of flies and mosquitoes, particularly in this territory, and asked Mr. Bain, superintendent of this drainage district, if they had ever had mosquitoes. He assured me that before drainage they had had plenty of them, and malaria too, but since getting proper drainage they were absolutely free from them. This, it seemed to me, was good news as we can hope some day to be free from this pest, particularly in the South.

At Rothamstead I, of course, visited the classic plots of Laws and Gilbert and viewed the tile drains which are the source of so much experimental data. I found that these drains were 3 and 4-inch tiles about 24 inches deep and emptied into an outlet ditch made of brick. The soil of the Rothamstead Experiment Station is clay with plenty of flint rocks. It did not seem to me an ideal soil for experimental work.

In Holland, of course, drainage is a very important item.

The Alsmeer district is where they have a peet soil, and the water level is only lowered from 12 to 18 inches below the top of the soil. It was kept that close to the surface because it saved money not to pump it lower than it was necessary. Farmers in this district grow nursery stock and do not require a deep seedbed. I also visited Haarlem Lake and saw the most excellent crops they were growing on the bottom of this one time lake.

One of the farms which I visited in this district had open ditches 150 feet apart and about 4 feet deep.

The Haarlem Lake pumping plant which I visited was using Diessel engines with a total rating of 150 horsepower. They are connected to centrifugal pumps and had a lift of 17 feet. It was claimed that they were lifting 250 tons per minute. This plant worked about 1500 hours per year and pumped 25 per cent of all the water that was taken from the lake. The other 72 per cent of the pumping was done at other plants which used electricity for power.

Holland is now working on another large drainage project similar to the Haarlem Lake. This is the drainage of Zuider Zee. It is a very large project and will take quite a long time involving the expenditure of considerable money. I crossed this body of water on a steamer and could hardly realize that some productive farms would take the place of this Zee.

General Observations. The people of Europe impressed me as having more home life than we have in America. Their homes are really homes. They seem to enjoy them. They are not always in a hurry to get away from them to go some place else. They seem to enjoy their family life and to take time for and pleasure in their meals.

Their houses are built as homes and constructed not for today alone but for a long time.

It seems to me that here is something for the American farmer to consider, as he usually takes more interest in his barn and the amount of land he owns rather than in his family and the kind of a home he has. Our urban population could also ponder this European characteristic.

Roads of Europe. The roads of Europe are very fine and they take considerable care of their grade crossings. Almost invariably these crossings are protected by two gates which are kept closed except as a vehicle comes along which demands that they be opened. The gate attendant who lives in a house at the side of the gate then goes out and opens the gate. I do not know whether these conditions will continue to prevail after the automobile gets more universal, but one thing is sure and that is that even though labor is cheap in Europe, human life is protected.

The Problem of Common Storage for Eastern Apple Growers

(Continued from page 265)

fall, and are hoping to obtain some thermographic records of performance under ice cooling which will indicate the possibilities for uniform temperature control when the practice is carried out in well-insulated cellars under good management.

In one such instance a storage room is located so near an ice house that cakes can be transferred from one to the other over a shute which will deliver them to water-tight racks placed near the ceiling of the storage room. Eight or ten cakes will be used at a time and allowed to melt without the use of salt, the melt water being collected in troughs or gutters in the floor and permitted to evaporate in order to maintain a high relative humidity.

In another cellar we are hoping to install steel road culverts suspended vertically from the ceiling and provided on the bottom with a wire screen. These will be placed in the intake ventilators and filled with cracked ice and salt from the floor above. Incoming air will be passed over and around them, being cooled in the process.

Ice has been used successfully to cool storage houses that are built entirely above ground.

J. R. Magness, of the U. S. D. A. Bureau of Plant Industry, took some notes on common storages and ice-cooled storages in the Hudson Valley in 1923. He reports the effective use of ice in racks in bringing the temperature of the storage room down to 40 or 45 degrees in warm weather, and states further that experienced men have been able to freeze the fruit by using salt to hasten the rate of melting. These houses are entirely above ground and of insulated construction.

An ice-cooled storage on the farm of the Massey Brothers, Winchester, Virginia, has operated successfully. It consists of a system of flues through which the air of the storage room is circulated by means of an electric fan. At one point in the flue system a large ice chamber is introduced, the air being forced past the cracked ice and salt, which is continually replenished from a hopper located just above the point where the air and ice come in contact. This type of system, however, is probably too expensive to install in competition with ordinary refrigerated storage in most cases.

In conclusion, I submit the following as our large problem in common storage for apples in Massachusetts: To provide some means for producing and maintaining storage temperatures as low as 40 degrees or less in cellar storages in the early storage season when Macintosh and Wealthies are being harvested. We are hoping to accomplish this by using ice, either with or without salt to hasten the cooling, and either with or without insulation against ground temperatures as may be determined to be necessary.

A series of tests to determine proper methods of controlling ventilation and humidity, and the effects of different methods of handling these factors on the quality of the stored fruit should be run in connection with trials for temperature control to determine how they interrelate. We want the answers to such questions as these. How important is temperature control in comparison with the need for ample ventilation early in the season? Will ample ventilation early in the season cause a more rapid melting of ice in order to control temperature than is economical, and if so, how much can the ventilation be reduced for the sake of temperature control, without adversely affecting the fruit? In other words, if temperature and humidity control and ventilation are antagonistic factors as regards their effect on the keeping quality of the fruit, which is the more important and in what degree should the less important be subordinated in operating the storage during the early part of the season? Answers to these questions will show us the limitations of common storages, and, within those limitations, how to design houses which possibly will enable our growers to hold the popular holiday varieties without recourse to the high-priced refrigerated storages which at present must be used seven seasons out of ten.

The term "agricultural engineering" has always been accepted as the standard term by the American Society of Agricultural Engineers. Such terms as "rural engineering," "farm engineering," and "farm mechanics" are sometimes used but are rapidly going out of use where work of engineering grade is referred to. The U. S. Department of Agriculture and nearly all the land-grant college and experiment stations now use "agricultural engineering" as the accepted term.

The Duties of the State in Public Drainage Proceedings*

By E. V. Willard

Commissioner of Drainage and Waters, State of Minnesota

IN TIMES like these when reaction from centralized wartime influence and control by the government is finding expression on every hand, government agencies find themselves on the defensive with respect to many of the functions already delegated to them. Attempts at additional governmental regulation of any kind, no matter how meritorious they may seem, are viewed with suspicion. As a war measure centralized government regulation was tolerated as a necessity. In times of peace, however, the American people, as a whole, chafe under too much government, a desire to govern themselves in all matters of local importance—our idea of liberty—being a national trait. When does or does not governmental interference constitute an encroachment on community liberty of action? are mooted questions.

Drainage of wet and marshy lands has never become a federal activity. Unlike irrigation, where the national government has reclaimed or attempted to reclaim hundreds of thousands of acres of federal-owned arid lands and by subsidy has encouraged private initiative to bring water upon additional large areas, the reclamation of wet lands has been accomplished wholly by the states and by private enterprise through the medium of state laws. During the early history considerable effort was directed towards the securing of aid from the federal congress for drainage development, but due to the fact that only comparatively small areas of marsh lands were owned by the government, the sponsors of the movement failed to arouse the necessary interest and support. The work, therefore, has progressed under the impetus and direction of local drainage districts. The organizations have learned that in most of their problems they are able to take care of themselves, and that the unnatural impetus given to any form of land development by outside aid too often results in the promotion of enterprises before they can be economically justified.

Notwithstanding the popular conception that drainage improvements are in their nature private enterprises and therefore are not looked upon as belonging in the class of activities subject to government control and supervision, there are nevertheless sound and valid reasons why the state should keep in touch with the problem in the interest of the general public welfare. These erasions may be classified as (a) scientific and (b) regulatory.

The need for scientific studies of physical conditions and the behavior of the forces of nature which make artificial drainage a necessity under any given conditions, requires no discussion or argument before a group of men trained in science and who by experience have learned the value of scientific research. It is, however, the most difficult phase of drainage development for which to stimulate an interest and secure support by the average citizen and the legislatures.

A thorough knowledge of the topography of the area to be reclaimed is basic to an intelligent design and satisfactory functioning of any extended drainage system. Topographic maps furnish this information. Not only do such maps serve as a base for drainage studies, but for nearly every other form of development on which a correct knowledge of surface configuration is dependent. It follows, therefore, that such mapping takes on the nature of a public necessity and should be undertaken at public expense. The local drainage districts, for economic reasons, cannot be expected to map the entire areas in which they are located, and for lack of such data many costly projects fail to function properly at critical times because of being inadequate in design. It is clearly the function of the state and federal government to do the work.

Closely allied to topographic mapping is the need of scientific investigations on the behavior of surface waters. The percentage of water furnished by precipitation during any given storm, series of storms, and during the year that will be taken up by a soil of given characteristics, and the portion of it that should be carried away by artificial means are primary considerations in the planning and designing of every drainage system. Even if the local district should desire to investigate for itself the behavior of soil and surface run-off waters within the area in which it operates, the nature of the problem would make such attempts of little avail. Stream flow observations to be of value, especially in problems involving flood control, must be conducted uninterruptedly over a sufficiently long period of years so that all critical stages and the probable frequency of their recurrence may be observed during a reasonably long period. Obviously, basic results cannot be secured within the time a drainage district ordinarily must carry through its plans for improvement. Again, as in the case of topographic mapping, an intelligent knowledge of the behavior of waters is of vital importance to the solution of many other problems in addition to drainage which concerns the general welfare of the public, and again it becomes the duty of the state and nation to provide for the initiation and maintenance of the work.

A knowledge of the soil characteristics and fertility of lands to be drained is of special economic importance and touches more intimately the individual landowner who is to pay the costs than probably any other phase of land drainage. A technically perfect plan based on a correct evaluation of the factors of topography and run-off would prove an economic disaster without the assurance that the soil to be reclaimed was fertile or could be made so within economic limits. Soil surveys are not only a necessity for successful drainage, but are basic for the most economical development of all land areas, are easily justified as a public necessity and should be undertaken by the state.

My observations on the need of scientific research in relation to land drainage are primary; they have been rehearsed and repeated until commonplace and perhaps have been tedious to you. Notwithstanding our own thorough appreciation of the value of undertakings of this nature, there is a lamentable lack of information on the subject on the part of the legislative bodies to whom we must look for the means with which scientific investigations of this kind are to be conducted and maintained. The legislatures and the general public are little concerned as to the methods employed by scientific and professional men in arriving at these conclusions. It is for this reason that it is proving difficult to impress upon those who depend on and have to seek the services of engineers and others whose leadership and advice is sought in the solution of development problems, that until authentic and basic information is made available duplication of effort, errors of judgment, unnecessary precautions due to uncertainties, guess work and unavoidable errors due to ignorance of conditions must continue to exact their toll from those who are finally called on to pay the bills. The education of the public to the value of fundamentals must be brought about through the medium of just such men and organizations as are here represented, by the creation of sound public policies and the tireless direction of public opinion towards a more liberal support of scientific research into the more practical problems affecting the economics of land development.

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So much for the duties of the state in matters scientific. The other phase of drainage development which in the opinion of many, including the speaker, should be given attention by the state was referred to herein as regulatory. To infer that the regulation of the practical details of a drainage system does not involve scientific consideration is probably stretching a point, but the classification is intended to make a distinction between matters which are general and apply to the entire state and those which more intimately concern each individual system.

The extent to which state regulation of drainage work should be permitted is by no means a settled question. The extremist on the one limit argues that the state should be given arbitrary power to approve of the selection of the engineer, make review of the appraisers' conclusions as to benefits and damages for the purpose of passing on the economical features of the proposed system, and to criticise and approve all of the plans and specifications before the project should be made the subject of hearings before the boards or courts. Those, on the other extreme, denounce any and all state interference in drainage matters as unnecessary and undemocratic. They argue that the entire cost is paid for by assessments against benefited lands, and the state, not contributing anything, is not justified in interfering or attempting to regulate enterprises of their own making. The ones who wish the state to do all usually have their origin in some local controversy where they have been disappointed by the acts of local officials. The ones who resent all outside interference are usually the local official who wishes to guard his own position and influence, and the head of the state drainage department whose ambition prompts him to extend his authority and influence.

Between these extremes there is a wide field in which efforts are being made to establish state regulation with varying degrees of success. Organic laws, established and recognized customs and legal practices, and public sentiment towards government regulation of local activities in general, make the extent to which state regulation of drainage enterprises are authorized, a matter peculiar to each state where drainage is an important factor. The following brief conclusions with respect to state regulation of drainage are based on my twenty years' experience in connection with the state drainage department of the State of Minnesota.

The state drainage department should be equipped and ready to give impartial and disinterested advice to property owners prior to the actual initiation of the proceedings. A discussion of the prospective project with one or more of the landowners who plan on initiating steps for drainage may result in directing their thoughts along channels that will either give added encouragement to undertake meritorious projects or else to discourage ventures of doubtful economic value.

In all matters the state's part in public drainage proceedings should be directory rather than mandatory. The influence for a higher order of workmanship can, in my opinion, be made more effective by the preparation, publication and distribution of educational pamphlets, charts, etc., for voluntary use and adoption each treating some pertinent subject in a popular way than would result from mandatory and arbitrary rules and regulations, and with less friction. Standard forms of specifications and contracts, legal blanks, profiles and maps distributed to drainage officials may not at first be productive of results, but if they are of a high order, their use will be reflected in plans and reports of local districts.

All reports, plans and specifications should be filed with the state department, and the executive state officer should be required to file with the proper local drainage official his approval of the plans, or in case that such approval cannot be given, his own report and recommendations before final consideration of the project may be given by the court or board. This is in no sense an unjust or arbitrary requirement. In case of failure to approve of a plan the state department is placed on the same level as the district when the project comes up for final hearing. The relative merits of the two reports are considered and the court finds on the showing made. The benefit of a doubt in such a case may be assumed to be given the engineer in the proceeding. Obviously this is as it should be. Such regulation implies cooperation between the local district and its engineer and the state department prior to the filing of the final report in order that there shall be no unnecessary controversy in court. It also implies the furnishing, by the state, of rules and regulations to govern the engineer in preparing his report so that it gives the information necessary to enable the state department to do justice in passing on the plans. If the state drainage commissioner, or whatever title he may have, shows a desire to serve rather than to be served and tries to guide and direct rather than to dictate, the objections which come from outside interference with local problems will be minimized.

The landowners in the states of Wisconsin, Iowa, Indiana, Ohio and Minnesota are expending millions on drain tile every year which they purchase from stock-piles in the yards of the local dealers or in carload lots from the factory without much thought being given to the quality of the product offered them. Materials entering into the construction of pavements, bridges, buildings and other structures, largely exposed to view and where the effects of wear and deterioration may be observed with comparative ease, are no longer accepted on the mere representations of the salesman, and placed in the structures by guess. They are subjected to scientific tests by applying to them, in the laboratory, as nearly as can be done, the same conditions as those to which they are to be exposed as ingredients or parts of the completed structures. The farmers who invest large sums of money in drain tile which are buried in the ground to a depth of from 5 to 30 feet should have every assurance that the tile have been properly made and that the drains will withstand the conditions to which they are subjected. In my opinion, there is no field in which the state can exert a greater beneficial influence in drainage work, than in protecting the farmer and drainage districts from the disappointments and loss of money and efforts which result from serious failures in costly tile drain systems. It is impossible even to approximate the effects in savings to the landowners by such regulation in Minnesota. There is unmistakable evidence of the manufacture of a higher grade of drain tile. According to the report of D. G. Miller, senior drainage engineer of the U. S. Department of Agriculture, who has charge of the laboratory and general inspection work in Minnesota, made last winter, so far as known no failures, due to disintegration, have occurred in any public ditch within the state in which tile were used made since the laboratory was established and inspection of tile by the state authorized. Again, as in other regulations the service is advisory and consultory with no powers to condemn or reject, which powers are left with the local officials whose duty it is to enforce the contracts. The manufacturers, as a rule, have cooperated in improving the quality of their products, and the engineers have availed themselves of the assistance rendered.

Finally, there is a function of the state entirely aside from an intimate touch with the plans of the local district. It involves the direction of a sound public policy with respect to the whole general subject of drainage in its relation to and its effects on the general public welfare. The drainage of wet and marshy lands and the reclamation of lands from floods are becoming more and more the subjects of public interest. The conservation of land as well as water areas for the purposes for which they are best suited in order that they be made to serve the greatest needs and demands of present and future generations is of paramount importance. Interest in extensive drainage projects extend beyond the boundaries of the local district and sufficient general concern over the probable effects of such improvements on future economics as well as aesthetic and recreational conditions, exists to justify the state in becoming a real active party to each drainage proceeding. Between the ambitious and greedy land grabber who would destroy lakes, forests and streams for selfish monetary gain on the one extreme, and the sportsman and wild life and plant preservation enthusiast who would have conditions perpetuated as the Creator left them on the other, there is need for the direction of the public mind along reasonable and conservative channels. The state, uninfluenced by local prejudices and factional strife, should direct such a public opinion, an opinion which recognizes vested private rights on the one hand and the rights of the public to enjoy that which rightfully belongs to it and no more on the other, and to save from exploitation for selfish gain or enjoyment areas which can serve a more beneficial purpose in their natural state.

Research in Agricultural Engineering

A department conducted by the Research Committee of the American Society of Agricultural Engineers

Research in Power and Labor Problems at Pennsylvania State College*

By H. B. Josephson

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AGRICULTURAL engineering advanced another step towards great recognition as one of the important branches of scientific agriculture when Prof. R. U. Blasingame of the Pennsylvania State College succeeded in convincing the authorities of that institution of the necessity for research on farm power and labor problems in Pennsylvania. While analyzing cost accounting records from actual farms in the state it was discovered that 65 per cent of the total cost of producing corn was chargeable to power and labor. This discovery led on to further study. In all major crops power and labor were the more expensive items. Here was a problem for agricultural engineers, and it was decided that, if at all possible, the department of farm machinery of the college should conduct an investigation looking toward the reducing of power and labor costs.

A project of preliminary study was drawn up and submitted to the U.S.D.A. Office of Experiment Stations at Washington. It was approved. As a result a portion of the money made available by the Purnell Bill for agricultural research has been allotted for this work and the project is being put under way.

The purpose of this preliminary project is to make an analytical and scientific study of the power and labor items in the cost of production of important crops in certain types of Pennsylvania agriculture, in order to determine specifically wherein these two items may permanently be reduced to a minimum. The excessive charge for power and labor is an obvious indication that our knowledge of fundamental facts involved in their proper use in crop production is inadequate. The necessity for analytical study to bring the problems involved to light, in order that they may be solved in the order of their relative importance, is apparent. It is hoped to supplement this preliminary investigation with fundamental studies of important specific problems as they become known.

What Farm Accounts Show

According to accurate farm accounts kept on 116 farms in Lancaster County, Pennsylvania, in 1923, the cost of power and labor in corn production was 65 per cent of the total. The items as listed are:

1. Labor 2. Power	65 per cent
3. Use of machinery 4. Rent of land 5. Taxes and insurance 6. Seed 7. Fertilizer 8. Cash expense	35 per cent
9. Profit	

Will 35 per cent cover items 3 to 8 and leave a sufficient margin to make corn production profitable? Unquestionably power and labor costs are too high.

For other crops the percentage of the total cost of production represented by power and labor was as follows: Wheat, 43 per cent; hay, 21 per cent; oats, 56 per cent; alfalfa, 39 per cent.

An economical reduction in any item entering into the cost of production will increase the profit just as surely as will a higher selling price.

Where Can Costs Be Lowered?

In endeavoring to lower the cost of production, the different items should be considered as to their relative susceptibility of reduction. Some items are to a large extent beyond control; others may be controlled in various ways. If an item is relatively large, it presents greater possibilities for reducing cost when it can to any degree be modified.

Labor as an item of expense varies within wide limits in the production of certain crops as shown by comparing records from different sections of the country. The main influences affecting the amount of labor used are machinery and power. When power and machinery are profitably substituted for man labor, it is evident that the reduction in labor cost has more than made up for the increased cost of the other two items. The final test for the machine must necessarily be: Can the operation be performed at a lower cost by the machine than it can by human hands? Those who advocate the use of machinery must, if they would be reasonable, recognize a limit beyond which the increase in machinery and power costs will exceed the saving in labor. Where this limit occurs cannot be easily determined. It is clear, however, that it must depend upon the following factors: (1) wages, (2) economy of the power used, and (3) the efficiency and general perfection of the machine used.

If it is accepted that farm machines are capable of improvement, that labor has been economically replaced in many cases by machinery and power, that power units have been and are being improved; then it follows that these three items—labor, power and machinery—present possibilities for modification.

Consider the other items: rent of land, taxes, insurance, seed, fertilizer. These items are controlled by various economic conditions and cannot to any appreciable extent be controlled by the individual farm operator, nor are they likely to be modified by engineering methods. It is for the economist and not for the engineer to seek means of reducing costs through these items. If these were the main items perhaps opportunity for lowering the cost of production would be slight.

The last item, listed as cash expense, is reported to include such items as twine, chemicals for treating seed, trucking to market, and threshing expenses. The last two mentioned would generally be included under labor, power and machinery.

Largest Items Most Readily Controlled

Labor and power, the largest items in crop production in Pennsylvania, are at the same time most susceptible of modification. This condition promises possibilities of lowering the total cost of production, for when these items are so excessive, it is obvious that they are out of balance with each other and with available mechanical methods and machines.

It is logical to consider in this connection that labor, power and machinery are interdependent; that a reduction in one may effect an increase in one or both of the other items. The work of the agricultural engineer must therefore take full cognizance of this basic economic consideration. Obviously a reduction of labor by the use of excess of power

and machinery would be futile. Out of this arises a specific problem that may be stated as follows: How can these items be balanced in such a way as to make their sum a minimum? This in brief may be considered as the specific requirement for assistance advanced by the farm management people to the agricultural engineers. It also emphasizes the utmost importance of close cooperation between the farm management people and the agricultural engineers.

Important as this problem is, it is not wholly fundamental in character. Its solution is largely dependent upon local conditions and requirements and the types of machinery and power under consideration. It is essentially a farm management problem, to the solution of which, however, agricultural engineers must contribute in a fundamental way. But as such it has not been given serious study in many instances. On this account and because its solution gives promise of quick financial returns, this feature of the problem should not be overlooked by agricultural engineers and should be kept in mind as the ultimate practical objective of their fundamental studies.

Some of the more important features of the problem that require the special attention of the agricultural engineer are the following: Are the machines used at the present time designed to do their work efficiently with a minimum utilization of power? This question may well be asked about the moldboard plow for instance. Are the sources of power most generally employed the most economical in cost? One immediately thinks of power waste through tractor wheel slippage and other deficiencies in farm tractor design due to inadequate knowledge of the specific requirements of power farming.

Very little research of a fundamental nature has been done attempting to solve such problems. However, what work has been done has revealed principles of untold value in the saving of power cost. This work has also indicated that in order to effect an economic balance of labor, power and machinery in farm management we must first learn the exact requirements of each production operation and develop or improve ways and means of meeting them specifically.

The Plan of Attack

Power and labor costs in the production of any given crop are made up of several items generally spoken of as operations. Machines have been built to perform many of those operations. Each operation, such as plowing or cultivation, for example, presents its own special problems which must be treated separately. In carrying out this project an analytical study is planned, using the operation as the unit.

A portion of the Pennsylvania State College farm has been allotted to the department of farm machinery on which to study these problems. This land will be operated in a four-year rotation of corn, oats, wheat and hay. Each operation of tillage, seeding and harvesting will be studied separately and careful records kept. Where the same operation is commonly carried on in several different ways, using different machines or different sources of power, it is planned to obtain records using the different methods. Modern equipment and labor-saving machinery will be used wherever possible.

The results of this analytical study will determine the future course of the work. Some operations in the growing of certain crops will no doubt be found to be particularly costly. When the important problems have been brought to light by this preliminary investigation, we hope to continue the study by attempting to solve these problems in the order of their relative importance.

It will be seen that this project has been planned with a view of obtaining results based on well-founded principles rather than to obtain immediate results which might only be temporarily and locally applicable. It is not improbable, however, that this method of attack may reveal certain important facts of immediate practical value during the early stages of operation. Such results although incidental and subsidiary to the main issue will not be kept under cover. It is the purpose and hope of the Department of Farm Machinery of the Pennsylvania State College to pursue this work in the open-minded way which has been characteristic of the agricultural engineering profession.

Selling Research

THAT the agricultural-engineering field offers unlimited opportunity for research goes without saying. Before the agricultural engineer can attempt the solution of the many problems demanding his attention, however, he must have the moral and financial support essential to such undertakings. He usually finds that to get a research project started he must do considerable so-called "selling" to persons on whom he is dependent for the necessary support. Therefore, he must never lose sight of the necessity of constantly making known to the little world about how important agricultural engineering is and how fundamental it is in agricultural development and as a means of making agriculture more prosperous and attractive for our best American farmers. You'll have to sell your research problems.

Power and labor represented 65 per cent of the total costs in corn production as shown by the Lancaster County, Pennsylvania, investigations; at the same time these two items are the most susceptible of modification. Mechanical power and labor-saving equipment combined with intelligent management constitute the most effective means of cutting power and labor costs in farm production. The outfit shown in the picture, consisting of a tractor, power-driven corn picker and wagon, is a typical example of the kind of equipment that reduces production costs. This outfit will pick five to seven acres of corn in a ten-hour picking and do a better job of picking than the average hand husker

Agricultural Engineering Digest

A review of current literature on agricultural engineering by R. W. Trullinger, specialist in agricultural engineering, Office of Experiment Stations, U. S. Department of Agriculture

A Study of the Effects of Anions upon the Properties of "Alum Floc," L. B. Miller (Public Health Reports [U. S.], 40 (1925), No. 8, pp. 351-367, pl. 1, figs. 7).—Studies are reported in which the importance of the negative ion content of the solution in relation to some of the chemical and physical properties of alum floc is established, and its bearing upon water purification by the alum process is discussed. Emphasis is placed upon the dependence of the physical state of the insoluble aluminum compounds formed upon the anions present.

The lack of agreement of other workers upon the region of H-ion concentration in which coagulation of alum takes place is explained as partially due to the negative ion content of the solutions in question and to the presence of colloidal material such as silicic acid or organic matter. For aluminum sulfate it is demonstrated that the so-called hydrion zone of rapid coagulation tends to shift toward the more acid portion of the so-called hydrion zone of coagulation. A few possible applications of the principles discussed are pointed out, and the coordinate importance of the aluminum ion and of the sulfate ion for current waterworks practice is emphasized.

Some Properties of Iron Compounds and Their Relation to Water Clarification, L. B. Miller (Public Health Reports [U. S.], 40 (1925), No. 27, pp. 1413-1419, figs. 4).—Studies conducted by the U. S. Public Health Service with ferric salts are reported, which showed that ferric floc possesses many of the properties of alum floc. With reference to the clarification of water by ferric salts, the same three chemical factors which determine the optimum conditions for the formation of alum floc were found to apply equally to the ferric floc. These are (1) the presence in the water of a certain minimum quantity of ferric iron, (2) the presence of an anion of strong coagulating power such as the sulfate ion, and (3) the proper adjustment of the H-ion concentration. Ferric floc differs from alum floc in that it does not redissolve at higher pH values. Less careful adjustment of pH at higher values is therefore required in order to form the ferric floc. The ferric floc begins to form at somewhat lower pH values than does alum floc. It is thought that this may prove to be an advantage under certain conditions.

Studies of Outlets and Crops on Sewage Irrigated Areas, G. A. Mitchell (Engineering News-Record, 92 (1924), No. 7, pp. 284-287, figs. 10).—Studies conducted by the U. S. Department Agricultural Bureau of Public Roads of sewage outlets from laterals on small institutional sewage irrigation areas are reported.

The main features of the latest and presumably permanent type are a cast iron outlet discharging horizontally, with the outlet and the sheet steel uptake leading to it from the vitrified pipe lateral protected by a cone of concrete.

Some comparative yields of crops on sewage irrigated and nonirrigated land are also included.

The Grading of Earth Roads, V. Overholt and C. H. Hooley (Ohio Agricultural College Extension Bulletin, 20 (1924-25), No. 5, pp. 18, figs. 20).—Practical information on the grading of earth roads is presented.

[Irrigation Investigations at the Colorado Station], R. L. Parshall (Colorado Station Report 1924, pp. 33-36).—A continuation of the Venturi flume studies showed that with the 1-foot flume a marked degree of submergences is possible before the discharge is reduced from that of the free flow due to the formation of a hydraulic jump within the structure. As the width of the throat increases the degree of the resistance to submergence also increases. For the smaller flumes the allowable degree of submergence is from 70 to 75 per cent, and for the larger sizes from 75 to 80 per cent.

Laboratory studies of evaporation to determine the effect of wind (E. S. R., 51, p. 684) showed that under still air conditions the rate of evaporation decreases as the difference in temperature of the air and water increases. Within the laboratory the maximum rate of evaporation occurs at about sunrise. Under fully exposed conditions the rate is greatest during the afternoon.

Some Experiments on the Rating of Current Meters, P. Phillips (Egypt Min. Pub. Works, Phys. Dept. Paper 14 (1924), pp. [1]+17; pls. [24]).—A new rating apparatus used at the Abbassiya Water Works is described, by means of which three quantities to be measured are all recorded automatically, thus avoiding all errors of personal observation. It also gives a smaller number of revolutions per minute for the same velocity than other apparatus.

A comparison of discharges at the low river stage downstream of Aswan and in the calibrated sluices at Aswan Dam showed that by using the old rating the discharges measured by the current meter were too low by 2.5 per cent for an average velocity of the water of 0.4 meter (1.3 feet) per second, and by 1.7 per cent for an average velocity of 0.54 meter per second. The new rating gave values for the discharges too high by 0.27 per cent for the low stage of the Nile.

When rating a current meter suspended at different points in front of a boat, it was found that for the same velocity the number of revolutions per minute was less than when the current meter was rated in the normal way hanging from the arm of the trolley. In most positions of the current meter the difference was not large, and at a distance as great as two meters in front of the boat the difference was almost negligible, and especially so when the current meter was fairly deeply submerged.

When the current meter was suspended at various distances from the side of the same boat, an increase in the number of revolutions was observed due to the proximity of the boat. Near to the side of the boat the difference was considerable, but at a distance of one meter away it was small, while at two meters' distance no difference could be detected. Rocking the boat, so as to give an up and down oscillation to the current meter in addition to its horizontal velocity, increased the number of revolutions of the Gurley meter. For low velocities this increase was very serious. The reverse effect was observed with a Haskell current meter of the propeller type.

Soil Colloids as Simple Suspensions, E. B. Powell (Soil Science, 19 (1925), No. 5, pp. 407-409, fig. 1).—Studies conducted at the Missouri Experiment Station on the theory of colloidal swelling in soils with rise in temperature as a factor affecting the rate of percolation through heavy subsoils are briefly reported. It was found that the swelling of colloids is insignificant over the temperature range used and can not be a contributor to the variation in rate of percolation.

Engineering Geology, H. Ries and T. L. Watson (New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1925, 3. ed., rev., pp. VII+708, pls. [4], figs. [409]).—This is the third edition of this book.

Researches on the Metals Employed in the Construction of Agricultural Machines [trans. title], M. Ringelmann (Ann. Inst. Natl. Agron., 18 (1924), pp. 205-248, figs. 9).—A rather detailed description is given of the methods of studying and testing the metals used in the construction of agricultural machines, employed by the machine testing station of L'Institut National Agronomique of France. These include wear tests in actual service.

The Form of Mechanical Composition Curves of Soils, Clays, and Other Granular Substances, G. W. Robinson (Journal Agricultural Science [England], 14 (1924), No. 4, pp. 626-633, figs. 2).—Studies conducted at the University College of North Wales, Bangor, are reported, in which the mechanical analyses of a number of soils, clays, and other granular materials was carried out, and the results set forth in the form of curves showing the relationship between summation percentages and the logarithm of settling velocity.

The curves obtained are smooth, suggesting that all of the necessary information as to the mechanical composition of a material can be obtained by using a relatively small number of experimental points and drawing the appropriate curve. Results obtained on one scale can readily be transferred to another scale by interpolation.

The most common type of curve is a sigmoid. The steepest portion of the curve represents the fraction present in greatest frequency, which is termed by the author the modal fraction. In the case of certain heavy clays, the modal fraction appeared to be at the lower end of the curve, while in the case of materials mechanically disintegrated the modal fraction was at the upper limit of particle size.

Composite curves are obtained in certain cases. They may represent mixtures of different materials or soils in the earlier stages of formation from rock.

The lower limit of particle size appears to be represented by log v=7.0000 in the case of normal soils and clays, in which v is the settling velocity. In the case of certain finely divided but nonplastic materials, the lower limit appears to be in the region of 5.0000. It is suggested that a better picture of the properties of soils would be obtained by taking the limit for clay at this point instead of at log v=4.0000.

The use of the logarithm of settling velocity as a measure of particle size is discussed, and it is suggested that the use of negative logarithms might be avoided by using log ($v \times 10^7$), for which the symbol Lv is proposed.

Farm Drainage Methods (Construction), 1908-1922, H. B. Roe (Minnesota State Bulletin. 217 (1924), pp. 5-44, figs. 51).—A large amount of information on the construction of farm drainage systems is presented, which is based on experience at the station during the period 1908-1922.

Foreign Material in Used Oil: Its Character and Effect on Engine Design, G. A. Round (Journal Society Automotive Engineers, 16 (1925), No. 2 pp. 232-236, figs. 11).—Studies of samples of used engine oil under the microscope are reported, showing that

the carbonaceous material is extremely finely divided and that the particles are held together loosely by oxidized oil. Dust particles in the oil can be distinguished from other material by means of photographs taken by polarized light. An examination of a number of samples showed that the dust particles circulating with the oil are small in comparison with those drawn in through the carburetor intake, indicating that they have been pulverized on the cylinder walls.

Further tests showed that air cleaners are of direct benefit, but that the use of other devices to prevent dilution and to keep the oil free from foreign material is equally desirable. While oil screens cannot be expected to remove any but the coarsest material, such as lint. They should, therefore, be of fairly coarse mesh and of liberal area in order to provide a free flow of oil at low temperatures, and should also be self-cleaning.

Studies on the Moisture Equivalent of Soils, J. C. Russel and W. W. Burr (Soil Science, 19 (1925), No. 4, pp. 251-266, figs. 9).—Studies conducted at the University of Nebraska on the effect of speed, period of centrifuging, and depth of soil layer in the cup on moisture equivalent for sixteen widely different soils are reported, the purpose being to formulate either a less empirical definition of the moisture equivalent or a better appreciation of the necessity of strict adherence to the present adopted procedure.

It was found that the relation of the moisture equivalent to the centrifugal force employed is not linear as previously suggested, but is represented by the equation $M=K\div G^n$, in which M is the moisture equivalent obtained at the centrifugal force G in terms of gravity, and n and K are characteristic constants for each soil. The moisture equivalent was found to be decreased about one per cent for each soil when the depth of the layer in the moisture equivalent cup is increased from 10 to 12 millimeters. The moisture equivalent decreased 0.6 per cent for each soil for each 20-minute increase in the period of centrifuging after the first 20 minutes.

The ratio of the moisture equivalent to the hygroscopic coefficient is practically linear only at 1,000 g and upwards. The equation of the relation of moisture equivalent and maximum water capacity to the hygroscopic coefficient is a simple parabola of form $a+bx+cx^2$=moisture equivalent, where x is the hygroscopic coefficient. For very low values of g, from 1 to 100, a, b, and c are constants of considerable magnitude. As the force of centrifuging is increased, first a and later c reduces to zero, and the equation becomes linear.

The relation of moisture equivalent to hygroscopic coefficient is not a natural constant, but an experimental one only, in which a considerable element of probable variation exists. The probable variation is the same at all centrifugal forces when the relation of hygroscopic coefficient to moisture equivalent is expressed as a quadratic formula, but when expressed as a linear formula the probable variation is a minimum between 1,000 and 1,500 g.

The results are taken to indicate that the moisture equivalent may be best determined by using a centrifugal force of 1,000 g, a depth of soil of 10 millimeters and a period of centrifuging of 40 minutes.

Water-Power Investigation of Deep River, T. Saville (N. C. Geological and Economical Survey, Economic Paper 54 (1924), pp. 43+18).—This report presents and analyzes data obtained from a water power investigation of Deep River in North Carolina and presents a comprehensive plan for the development of the entire river, looking toward the interconnection of present and future hydro—and steam plants on the river.

Reinforced Concrete Bridges, W. L. Scott and C. W. J. Spicer (London: Crosby Lockwood & Son, 1925, pp. XI+207, pls. 22, figs. 116).—This book deals with the practical design of modern reinforced concrete bridges, especially from the British viewpoint, and includes notes on temperature and shrinkage effects.

Resistance of Materials, F. B. Seely (New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1925, pp. XIII+442, figs. 314).—This book is divided into two parts. Part one, on mechanics of materials, treats chiefly of the application of the principles of analytical mechanics and of the experimental laws of structural materials to the analysis of the action of the members used in structures and machines. Part two deals chiefly with the structural, or force resisting, properties of engineering materials.

Irrigation Farming in New South Wales, A. N. Shepherd (New South Wales Department Agricultural Farmers' Bul. 148 (1925), pp. 57, figs. 26).—This bulletin deals with the planning of an irrigation farm, soil improvement and crop rotation, and the growing of different crops under irrigation.

Standard Electrical Dictionary, T. O'Conor Sloane (New York: Norman W. Henley Pub. Co., 1924, rev. and enl. ed., pp. 790, figs. 497).—This is an encyclopedia of the science of electricity in all its phases and in its most recent developments, with definitions of terms and descriptions and illustrations of electrical appliances and connections and a presentation of modern electrical theory, experimentation, and engineering.

The Physical Characteristics of Road and of Field Dust, C. E. Summers (Journal Society Automotive Engineering, 16 (1925), No. 2, pp. 243-247, figs. 8)—The results of a two-year study on the chemical composition, particle size, specific gravity, and abrasive nature of road dust and relative amounts of it to which an engine may be exposed under varied conditions are briefly reported.

Chemical analyses showed that samples of road and field dust taken from different states vary considerably in composition, from 90 to 98 per cent by weight being mineral matter. Road dust particles of different chemical composition do not differ materially in abrasive character, however. The specific gravity of dust particles varies somewhat, but is about 2.5, which corresponds very closely to that of quartz. Dust, therefore, is not in itself a light substance, and its ability to float in the air for a length of time is a function of its size rather than of its specific gravity.

In the connection it was found that a size of particle is finally reached at which its weight is not sufficient to move it at any considerable velocity against the friction and viscosity of the air. Thus, when a large number of particles of varied sizes are thrown into the air by any violent agitation, the larger ones fall rapidly and remain suspended only a few seconds. The smaller the particles are the longer they will remain suspended, until the very finest fall so slowly that the eddy currents of the wind tend to carry them upward. So far as could be observed no dust exists which is harmless from the abrasive standpoint, although the very fine particles were found to be somewhat less abrasive than an equal weight of coarse material.

Studies of engine wear showed that where dust is present more wear exists at the top than at the middle or the bottom of the cylinder, due probably to the fact that the surface at that point is exposed to dust lodgment during a greater period of time and that the lubricating film is thinner.

Methods of testing air cleaners are described.

The Effect of Irrigation upon Soil Temperatures, E. McK. Taylor (Egypt Min., Agr. Tech. and Sci. Serv. Bul. 53 (1924), pp. 18, pls. 7).—Studies of soil temperatures under various crops and on fallow land receiving irrigation are reported.

It was found that the effect of irrigation is determined mainly by the temperature conditions of the soil immediately prior to irrigation. If the surface soil temperatures are higher than those of the lower layers, increases in the temperature of the lower layers take place on irrigation, and vice versa. The temperature effects of irrigation are attributed to the displacement of the water already present in the soil by the addition of irrigation water to the surface. The effect of rain upon soil temperature is shown to be similar to that produced by irrigation water, but not of the same magnitude, owing to the different rates at which the water is placed upon the surface of the soil. It is also shown that the conductivity of the soil is increased by irrigation. The suggestion of Keen and Russell, that the diffusivity of soil increases to a maximum with increasing moisture content and finally decreases as the moisture content is further increased, was confirmed.

Accurate Accelerometers Developed by the Bureau of Public Roads, L. W. Teller (U. S. Department Agriculture, Public Roads, 5 (1924), No. 10, pp. 1-9, figs. 15).—Accelerometers developed in connection with the studies of impact of tfucks on pavement are described, and data from their calibration are tabulated.

How Deep Should We Plow? L. E. Thatcher (Ohio Station Monthly Bulletin, Wooster 10 (1925), No. 1-2, pp. 3-6).—Data from deep plowing experiments for corn and wheat in a four-year rotation of corn, oats, wheat, and clover are briefly reported. These indicate that although plowing deeper than ordinary as a regular practice has not shown a profit in crop returns, an occasional deepening of the plow furrow may be very beneficial under certain circumstances. Apparently the least effective method in both experiments, as measured in crop yields, is that of deep tillage with the disk plow.

Reclamation of Automobile Crankcase Oil, C. Van Brunt and P. S. Miller (Indus. and Engin. Chem., 17 (1925), No. 4, pp. 416-423, figs. 4).—Experiments are reported which showed that by treating the used oil from crankcases hot with a small quantity of concentrated solution of sodium silicate, usually proceded by the addition of a metal resinate and stearic acid, a sludge is formed which carries all solid and other deleterious impurities, and which not only settles in a few minutes but sinks completely into an underlying body of water. The diluents are removed by a supplementary heating in a thin film. An apparatus for carrying out the process automatically and continuously in units adaptable to ordinary service has been devised.

Pumping for Drainage in the San Joaquin Valley, California, W. W. Weir (California Station Bulletin, 382 (1925), pp. 3-38, figs. 18).—This bulletin reports an attempt to gather together and correlate some of the important data on pumping for the drainage of irrigated lands in the San Joaquin Valley, California. It is stated that the cost of drainage by this method compares favorably with that of any other method yet tried, although the cost of operation is more. It has been found that more effective drainage may be accomplished by pumping than by tile or open drains because of the flexibility of the pumping system and the greater depth to which it is economically feasible to lower the water table. The pumped water is readily available for irrigation and compensates in part for the cost of drainage by this method.

The Fundamental Cause of the Disintegration of Concrete, A. H. White (Concrete [Detroit], 26(1925), No. 5, pp. 157-161, figs. 7).—The results of a large number of studies are summarized, indicating that alternate expansion and contraction due to changes in moisture is the greatest underlying cause of the destruction of concrete structures, since the strains due to the volume changes produced by variations in the water content are usually far greater than those due to changes of temperature. If concrete is to be permanent, its moisture content must remain relatively constant, the absolute quantity of combined water being relatively immaterial. The greatest trouble is found in concrete exposed to the weather when the moisture content of the surface changes much more rapidly than that of the interior, resulting frequently in a differential expansion and shearing stress.

A. S. A. E. and Allied Activities

Farm Machinery Meeting

THE plans and program for the meeting of the Farm Power and Machinery Division of the American Society of Agricultural Engineers to be held at the Great Northern Hotel, Chicago, December 1 and 2, are well advanced. The program will be of interest to a large number of engineers and manufacturers and promises to be the best which the division has ever presented.

The first day of the meeting will be devoted to papers and discussions of interest to engineers associated with the development of farm machinery. Practically all arrangements have been completed for the papers and speakers which will appear on the first day's program. The meeting will be called to order at 9:30 A.M. central standard time and will be opened by the presentation of a paper by Burton Harris, of the Massey-Harris Harvester Company, on the engineering development of the combined harvester-thresher. The greater portion of the forenoon session will be devoted to the discussion of this timely subject which is occupying the attention of many engineers in the industry at this time. The discussion will be supplemented by reports from Wisconsin and Illinois on the work that has been done by the departments of agricultural engineering in these two states in solving the problem of drying grain after it is harvested by the "combine," particularly with reference to meeting conditions in humid regions. As the minor topic for the morning session F. W. Duffee, associate professor of agricultural engineering at the University of Wisconsin, will report on this year's work in continuation of the silo filler tests which have been conducted at Wisconsin for the past two years.

A feature of the program for the afternoon session of December 1 will be a paper dealing with the engineering problems involved in the development and application of disk plows by R. C. Ingersoll, of Galesburg Coulter-Disk Company. Another feature of the afternoon session will be a progress report on the work being done at the Alabama Agricultural Experiment Station on tractor lugs, which will be presented by Prof. M. L. Nichols or J. W. Randolph of that station, both of whom are actively engaged in this particular research work.

The second day of the meeting will be devoted to a standards round table, at which time engineers from the farm-equipment industry will make definite recommendations for standardization of various items of importance to the industry. These recommendations will be discussed during the session and special committees subsequently appointed to consider the recommendations and eventually formulate standards to be submitted for adoption by the Society.

A special luncheon and get-together will feature the program on each day.

Those attending this meeting will have the benefit of reduced fares which will be in force during that week, which is the week of the International Livestock Show. Those attending should purchase round-trip tickets and be sure to get the reduction to which they are entitled. One and one-third fares can be obtained for a round trip from the states of Idaho, Utah, Montana, Wyoming, Colorado, North and South Dakota, Nebraska, Kansas, Minnesota, Iowa, northern Missouri, Wisconsin, and northern Illinois. One and one-half fares for round-trip tickets will be in force from central and southern Illinois, Indiana, Ohio, and lower Michigan.

In the territory affected by the one and one-half fare rate, the dates of sale of reduced fare tickets are from November 30 to December 4, and the returning limit is December 6. For the one and one-third fare rate, from Missouri River points and east, the dates of sale are November 27 to December 2 for returning not later than December 7, and from Missouri River points and west, the dates of sale are November 26 to 28, returning not later than December 8.

The Better Farm Homes Conference

THE Council of the American Society of Agricultural Engineers has given its approval to the holding of a "Better Farm Homes Conference" in Chicago in January, 1926, under the auspices of the Farm Structures Division of the Society.

To date no organization has strongly backed any definite better farm homes movement, although the city home has been given considerable attention by various publications and organizations of one sort and another, especially in connection with the national "Better Homes Week." Because of the fact that the American Society of Agricultural Engineers is interested and active in practically all phases of better farm homes, it is the logical organization to promote and unify activities in connection with the better farm homes idea. The A.S.A.E. committees on farm sanitation, farm home equipment, building code, building design, etc., are all working more or less in the direction of better farm homes.

The tentative plans for the conference call for a two-day meeting, the first day of which will be devoted to general subjects and the second day to the more specialized subjects represented by various committee activities. In the tentative program that has been drafted it is proposed to have a paper by a nationally known artist, architect, or household management expert; a paper by an authority on better farm homes as related to the better homes movement in general; a paper on what better farm homes will be; a paper on the farm building code for better homes; and papers on such subjects as fire prevention, home equipment, sanitation, materials, etc. Included in this program also it is proposed to provide for a general discussion and formulation of a program looking to establishing the better farm homes conference as an annual event.

While the Better Farm Homes Conference is being sponsored by the Farm Structures Division of A.S.A.E., other organizations actively interested in the subject of better farm homes and allied manufacturers will be invited to send representatives to contribute to the program in a way that will make the event constructive and worth while to all interested.

Inquiries or suggestions relative to the conference should be addressed to D. G. Carter, chairman of the Farm Structures Division, Fayetteville, Arkansas, or to Raymond Olney, Secretary of A.S.A.E., St. Joseph, Michigan.

Executive Committee of Pacific Coast Section Meets

THE executive committee of the Pacific Coast Section of the American Society of Agricultural Engineers met in Berkeley, California, October 5. The members of the executive committee present were Frank Adams, chairman; M. E. Cook, vice-chairman; F. J. Southerland, director; and L. J. Fletcher, secretary. O. V. P. Stout and Dr. Samuel Fortier were also present at the meeting.

The purpose of the meeting was primarily to make plans for the 1926 annual meeting of the Society to be held at Tahoe Tavern, Lake Tahoe, California, June 23, 24, 25, and 26, 1926. L. J. Fletcher having been appointed by the president of the Society to serve as chairman of the 1926 Meetings Committee, it was necessary to complete arrangements for other committees to handle various phases of the preparation for the annual meeting. B. D. Moses was appointed chairman of a transportation committee to attend to all matters having to do with the special train from Chicago to Lake Tahoe and inquiries relative to railroads and automobile road facilities. H. A. Wadsworth was appointed chairman of a local arrangements committee to look after local arrangements during the time of the meeting at Lake Tahoe, including general entertainment,

entertainment for ladies, reception, sports, banquet arrangements, etc. S. H. Beckett was appointed chairman of a committee to look after arrangements for the inspection trips following the annual meeting sessions. Max E. Cook was given complete charge of handling all publicity in connection with the annual meeting. A group consisting of P. E. Holt, Walter Packard, F. J. Southerland, Max E. Cook, and C. H. Hopkins were delegated as members of a special committee to arrange for the financing of the entertaining of the convention by the Pacific Coast Section. C. F. Shaw was appointed chairman of a special committee to handle inquiries relative to other places in California which those attending the convention may wish to visit following the annual meeting session.

The Executive Committee set the date of the next meeting of the Pacific Coast Section at Davis, California, as December 17 and 18. "The Place of A.S.A.E. in Reclamation" is the principal topic for discussion at this meeting.

The Pacific Coast Section is to make a special drive for new members, and a special committee has been appointed for that purpose. The goal is 75 members in the Section by June, 1926.

The N.A.F.E.M. Convention

THE thirty-second annual convention of the National Association of Farm Equipment Manufacturers held in Chicago October 28, 29, and 30, 1925, marked an important milestone, not only in the advancement being made by the industry, but particularly in the recovery that is being made by the industry, following the period of post-war depression, which was unquestionably the worst period ever experienced in the history of the industry. The industry is unquestionably entering a new era, and an era which will undoubtedly be marked by outstanding developments along engineering lines.

Some of the more important addresses which were a feature of the convention included an address by the Hon. W. E. Humphrey, member of the Federal Trade Commission; the development in the transportation situation as it affects the shipper, by J. H. Beek, executive secretary of the National Industrial Traffic League; the relation of electrical power development to the farm-equipment industry, by O. B. Zimmerman, of the International Harvester Company; an address by J. W. O'Leary, president of the Chamber of Commerce of the U.S.A.; an address on the progress of development of farm equipment by A. E. McKinstry, vice-president of the International Harvester Company; and an address on the activities of the American Society of Agricultural Engineers by F. A. Wirt, president of the Society.

The impressive address of President Wirt was received by the convention with a great deal of interest and enthusiasm and is indicative of the much greater recognition which the Society is receiving from the industry at large. Mr. Wirt outlined in considerable detail the various activities of the Society, and pointed out in an effective manner how the members of both organizations have very much in common. Mr. Wirt concluded his address with the statement: "Briefly, the American Society of Agricultural Engineers encourages the development and improvement of farm machinery, fosters a more efficient utilization of machinery, and stimulates the increasing use of more and better equipment. With your continued cooperation the Society can be of greater service to the best interest of the American farmer."

The remarks of Finley P. Mount, president of the association, immediately following Mr. Wirt's address, are particularly interesting and significant to agricultural engineers. He said, "I would amend the last statement made by the speaker. After listening to that paper, I don't think it should be our continued cooperation; it should be our increased cooperation. The American Society of Agricultural Engineers has been doing a wonderful work and are entitled to a more generous and more unanimous support by the manufacturers. On behalf of the association I want to thank the speaker for the splendid presentation of this subject."

Mr. Mount in his presidential address commented on the activities of the Society in a way that reflected a great deal of credit to the organization.

The resolutions adopted by the association in convention included one relative to A.S.A.E. as follows:

"RESOLVED, That this Association reiterates its commendation of the activities of the American Society of Agricultural Engineers, and requests its membership to cooperate with this Society whenever requested and is practicable to do so."

Another resolution passed by the convention of interest to agricultural engineers is the following relating to the survey of agricultural engineering research and investigational work in farm equipment at the land-grant colleges, which will be directed by Prof. J. B. Davidson, of Iowa State College:

"WHEREAS, the invention, manufacture, and use of improved farm machinery has been the significant feature in the development of American Agriculture, and

"WHEREAS, the American farmers' future security in agricultural supremacy lies in the continued improvement and use of equipment to reduce labor and power costs or to improve crop yields or quality, and

"WHEREAS, efficient production methods possible through the adaptation and use of new machinery and processes is vitally necessary to the preservation of the American farmers' economic position and standard of living, and

"WHEREAS, the land-grant colleges and experimental stations have been and can be of invaluable service in technical training, in investigational and research work and in disseminating agricultural knowledge, and

"WHEREAS, the Honorable Secretary of Agriculture, W. M. Jardine, has arranged for a survey of research and investigational work in mechanical farm equipment,

"THEREFORE, BE IT RESOLVED that we hereby express our thanks for the interest and assistance as evidenced by the action of the Honorable Secretary of Agriculture and that we pledge the United States Department of Agriculture our hearty support and cooperation in the survey to be made, and

"BE IT FURTHER RESOLVED that we record our appreciation of the splendid services rendered by our land-grant colleges and experiment stations and especially the agricultural engineers affiliated with these institutions, and that we request their continued and intensified cooperation in the further agricultural-engineering research work which is so essential to keep America preeminent in agriculture."

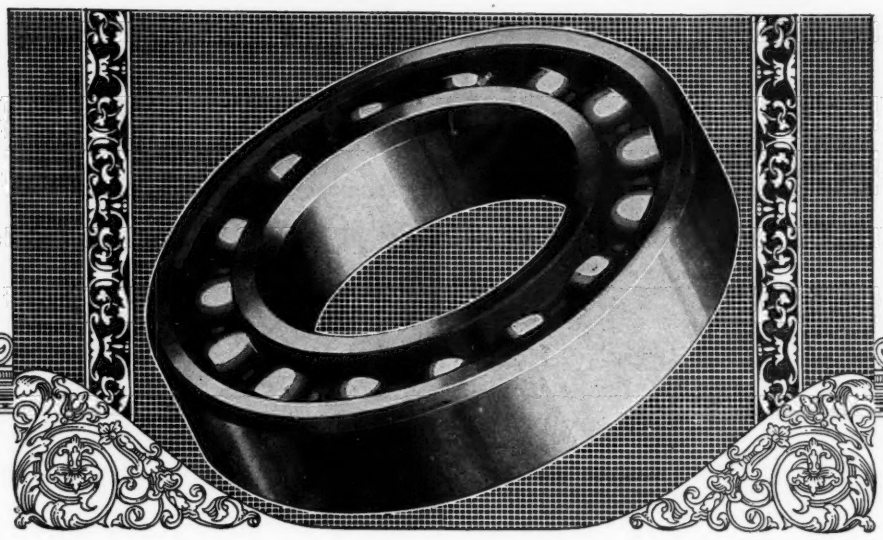
Davidson to Conduct Agricultural Engineering Research Survey

PROF. J. B. DAVIDSON, head of the agricultural engineering department at Iowa State College, has been selected by the U. S. Department of Agriculture to head the farm operating equipment research survey that is being developed as a result of a conference last summer between Secretary Jardine and a committee representing the American Society of Agricultural Engineers and the National Association of Farm Equipment Manufacturers. That Prof. Davidson's assignment to this task will insure its energetic prosecution and efficient handling in general will be generally accepted. However, he will not be able to give full time to the work before the first of the calendar year. There is a great deal of preliminary work to be done, however, and this is now under way.

At a recent conference between Prof. Davidson and S. H. McCrory, chief of the division of agricultural engineering of the U.S.D.A. Bureau of Public Roads, a plan of procedure for the immediate future was mapped out. Prof. Davidson will, as expeditiously as possible, outline the problem as he views it. This will be submitted to members of the advisory council, created by the Department of Agriculture, for their criticism and suggestions. A revised schedule will then be sent to all the college department of agricultural engineering and to the implement manufacturers. As soon as practicable thereafter, a meeting of this advisory council will be called and plans put in active operation.

Realizing the far-reaching importance of this project, Secretary Jardine has designated the following nineteen men (thirteen of whom are A.S.A.E. members) to act as members

New Departure Ball Bearings



FARM machinery equipped with New Departure Ball Bearings is an investment in long life and uninterrupted service.

The ball bearing is the freest running bearing yet devised. This fact alone would mean a freedom from bearing wear not otherwise possible. It thereby eliminates the need for adjustable features.

The net result is a long-lived, tamper-proof bearing which maintains correct shaft alignment, proper gear tooth pitch contact and "tightness" of wheel spindles.

Hence, the New Departure-equipped tractor or farm machine is well worth any difference in price there may be over those with plain or other less efficient bearing types.

Ask for the "Special Application Bulletins on Farm Machinery," a technical treatise with much valuable engineering data to assist you in your design.

THE NEW DEPARTURE MANUFACTURING COMPANY

Detroit Bristol, Connecticut Chicago

of the advisory council, all of whom have consented to serve:

R. U. Blasingame, Pennsylvania State College
L. J. Fletcher, University of California
J. B. Davidson, Iowa State College (Director)
F. W. Duffee, University of Wisconsin
G. W. Iverson, Advance-Rumely Thresher Company
H. C. Lisle, Bean Spray Pump Company
R. B. Lourie, John Deere Plow Company
Thos. H. McDonald, U.S. Department of Agriculture
S. H. McCrory, U.S. Department of Agriculture (Secretary)
D. McDonald, Jr., B. F. Avery & Sons
J. C. Myers, F. E. Myers & Bro. Company
M. L. Nichols, Alabama Polytechnic Institute
Dan Scoates, Texas A. and M. College
C. E. Seitz, Virginia Polytechnic Institute
O. W. Sjogren, University of Nebraska
H. B. Walker, Kansas State Agricultural College
W. L. Weintz, J. E. Porter Corporation
F. A. Wirt, J. I. Case Threshing Machine Company
A. P. Yerkes, International Harvester Company

Activities of Student Branches

Nebraska Students Take Over Plow Factory

FIFTY-THREE agricultural-engineering students at the University of Nebraska took charge of the Chase Plow Company at Lincoln, Nebraska, October 10 and operated it for half a day. This unusual activity was sponsored by the student branch of the American Society of Agricultural Engineers at that institution in cooperation with the faculty of the engineering department and L. W. Chase, president of the Chase Plow Company and former head of the agricultural-engineering department at the University of Nebraska.

The students took complete charge of the factory and were instructed in their jobs by the factory workmen themselves. The work was divided into twenty-two jobs and assignments were made so that each man was given a chance to work at several different jobs. Little did the students realize the number of operations necessary to produce a finished lister or cultivator or the number of parts to be handled in the manufacturing of such implements. Mr. Chase addressed the students before starting them to work, and in his talk he indicated that such a procedure is entirely unheard of because a company is taking a great deal of risk in allowing a group of students without experience to take control of a factory and actually run it from piling the iron to polishing the moldboards for listers. He indicated, however, that he felt confident of the outcome because he had been a teacher himself and knew students.

The office work, which was included in the work to be done by students, was one of the jobs that looked easy, but proved to be more difficult than the students had anticipated. One of the assemblies were given to each student in the office for a classified list of materials preparatory to ordering the stock from the mill. There were four kinds of material and twenty-seven pieces in the assembly. Everything went well until it came to ordering the material for five hundred such assemblies.

There were over 100 different operations in the 22 jobs given the boys. The two-row cultivator manufactured in this factory required 862 pieces and two-row lister 513 parts. Another surprising fact to the class was that it required twenty-two operations to assemble a seed box and dropping attachment for a lister.

New A.S.A.E. Members

Roy E. Murphy, superintendent of Forestdale Farm, West Burlingame, Iowa.

William E. Stanford, instructor in agricultural engineering, Oklahoma Agricultural and Mechanical College, Stillwater, Okla.

Transfer of Grade

Frank D. Jones, instructor in agricultural engineering, University of Tennessee, Knoxville, Tenn. (From Student to Junior Member.)

Applicants for Membership

The following is a list of applicants for membership in the American Society of Agricultural Engineers received since the publication of the October issue of AGRICULTURAL ENGINEERING. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Charles Allen Bacon, manager, research and educational department, Oliver Chilled Plow Works, South Bend, Ind.

Lucas Smith Caple, rural service engineer, Rochester Gas & Electric Corporation, Rochester, N. Y.

Curtis I. Cohee, Jr., director, quality control department, Philadelphis Inter-State Dairy Council, Kennett Square, Penna.

Elmer William Hamilton, in charge of research work, Clarke Publishing Company, Madison, Wis.

Allen Crosby Hardison, civil engineer, Santa Paula, Calif.

George Innes, president, Innes Shocker Co., Davenport, Iowa.

Robert H. MacDonald, manager, Philadelphia office, The Louden Machinery Co., Philadelphia, Penna.

Employment Bulletin

This service, conducted by the American Society of Agricultural Engineers, appears regularly in each issue of Agricultural Engineering. Members of the Society in good standing will be listed in the published notices of the "Men Available" section. Non-members as well as members, are privileged to use the "Positions Available" section. Copy for notices should be in the Secretary's hands by the 20th of the month preceding date of issue. The form of notice should be such that the initial words indicate the classification. No charge will be made for this service.

Men Available

AGRICULTURAL ENGINEER open for position as sales engineer, salesman, advertising writer, or agricultural propagandist. Past experience with large agricultural firms. MA-124.

AGRICULTURAL ENGINEER, 1925 graduate of Kansas State Agricultural College, with farm experience, would like permanent employment at once, preferably with a farm-machinery manufacturer. MA-126.

AGRICULTURAL ENGINEER, 1925 graduate of College of Agriculture, at the University of Illinois, who has specialized in tractors and farm-power machinery and lubrication, and who has had eight years' experience in the operation, repair, and demonstrating of tractors and related farm machinery, desires a position preferably with a farm-machinery manufacturer or oil company. MA-127.

Positions Open

AGRICULTURAL ENGINEER to teach farm buildings, agricultural drawing, rural architecture, and to handle the extension work in farm buildings is needed at Virginia Polytechnic Institute, Blacksburg, Virginia. The work is so arranged that one-half time will be devoted to resident instruction and the other half to extension work. Most of the extension work at present is confined to actual designing of farm structures with some field work. A man is wanted who is capable of developing the extension phase of the work to the highest efficiency. Those interested should write C. E. Seitz, head of the department of agricultural engineering.

SALES ENGINEERS WANTED: One of the largest bearing manufacturers in America can use the services of two good sales engineers. Men with an engineering education and sales experience in farm tractor and implement field are preferred. They should have designing ability so that they can be of service to customers. Those experienced in the farm-implement and tractor design will be shown preference. Write fully giving all data as to experience, education and salary expected.

ENGINEER wanted, by one of the largest farm-machinery manufacturers, who is alive to the real engineering possibilities incidental to the manufacture of farm machinery, whose theoretical engineering training is complemented by a few years work at the drawing board in some engineering department and who will at once know the significance of routine efforts necessary to the accomplishment of any job in a production shop and be in position to appreciate the shop man's viewpoint. PO-111

EXTENSION AGRICULTURAL ENGINEER qualified to handle farm machinery and gas engine schools in various communities in the state, and also qualified to handle other lines of agricultural-engineering activity which an extension man is called upon to perform is wanted by the University of Nebraska. Candidates for this position should write O. W. Sjogren, chairman, department of agricultural engineering, Lincoln, Nebraska.

Assured Profits!

Profit—of one kind or another—is your reason for putting a tractor to work on your farm.

Your best assurance of profit lies in: first, the reputation of the machine you buy, and, second, the standing and stability of the manufacturer.

The Case tractor comes to you a proven money-maker for its owners. This reputation is established beyond dispute by the experience of thousands of successful, satisfied Case owners, operating in more than 100 different countries.

The Company was founded in 1842, eighty-three years ago. During all these years it has specialized in the building and developing of machines that would surely produce profit for their owners. Its growth has been of the steady, substantial kind that best assures continued operation and success.

This is your assurance of profit, satisfaction and service when you buy a Case tractor. There are three sizes—one just right for your conditions. Prices represent the best value the market affords. The reasons why Case tractors are giving such universal satisfaction are yours for the asking. Write for them—today—before you forget.

J. I. Case Threshing Machine Co., Inc.

Dept. L58 Established 1842 **Racine, Wisconsin**

CASE

TRADE MARKS REG. U.S. PAT. OFF AND IN FOREIGN COUNTRIES

FARM TRACTORS

NOTE • Our Plows and Harrows are NOT the Case Plows and Harrows made by the J. I. Case Plow Works Co.

Using the

A GANG plow and a tractor will turn two or more furrows at a time. It pays to use machinery—if your farm is large enough.

But large-scale production means a large-scale risk. To spread this risk, and to make the fullest use of land and labor and equipment, the farmer turns to diversified production.

The first electric light and power plants produced but a small "crop" of a single service—lighting. As the demand grew, interconnections made it possible for a larger plant to serve a wider territory. Diversification, too, was sought by developing new uses for electric power.

Based on these principles of large-scale production and diversification, our present so-called "super-power"

NATIONAL ELECTRIC

29 West 39th Street

Gang Plow

systems have grown up. These are the systems which have made it possible to use the "gang-plow" in electric-power production and to extract much more electric power from each pound of coal than even the best of "small-scale" power stations could produce back in the "old-days"—twenty years ago.

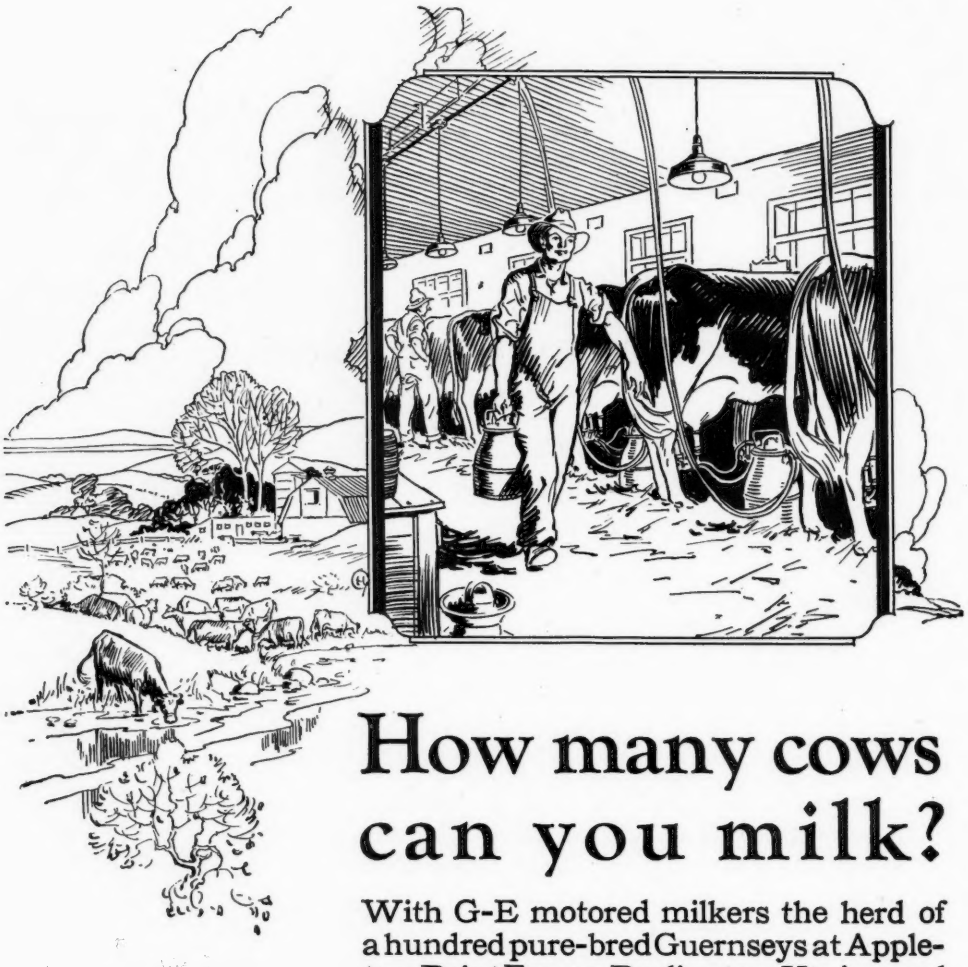
To extend the benefits of so-called "super-power" to agriculture, fifteen state committees are at work with the national committee in studying the problems of farm electrification.

The Committee on Relation of Electricity to Agriculture is composed of economists and engineers representing the U. S. Depts. of Agriculture, Commerce and the Interior, Amer. Farm Bureau Federation, National Grange, Amer. Society of Agricultural Engineers, Farm Lighting Mfg. Ass'n, and the National Electric Light Association.

If you are interested in this work, write for a booklet describing it.

LIGHT ASSOCIATION

New York City, N. Y.



How many cows can you milk?

With G-E motored milkers the herd of a hundred pure-bred Guernseys at Appletree Point Farms, Burlington, Vt., is cared for by two men.

Electricity is also used on this farm for cutting ensilage, sawing wood and threshing as well as cooking, cleaning and other household work.

Electric farm motors bring more profit and take away drudgery.

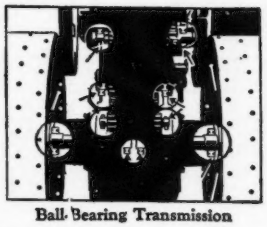
The General Electric Company designs motors for use in the household, on the farm, in the factory, on ships and railroads—wherever power is needed to do man's work.

GENERAL ELECTRIC

More power *for actual work*

No friction to steal away your power
in this smooth-running ball-bearing transmission

In the *Light-Weight* OilPull, Rumely engineers have achieved another distinct triumph in tractor engineering. Power loss in bearings and gears has been reduced to practically nothing. **Friction,** the power thief—the cause of rapid deterioration—of breakdowns—of lost time—of heavy repair expense and many other ills—**has been shackled.**


Ball-Bearing Transmission

This has been done, **first,** by means of a **Ball Bearing** Transmission. All shafts in the transmission of this OilPull Tractor are mounted upon smooth-running, **annular ball bearings.** The rear axle is likewise ball-bearing mounted. Each bearing is housed individually and packed in grease. **Second,** every gear inside the transmission is machine cut, with case-hardened teeth. And the complete transmission is enclosed in a dust-proof case and operates in a bath of oil.

Frictionless construction is only one feature of the *Light-Weight* OilPull which assures **more power** for plowing, discing, cultipacking and many other drawbar and belt jobs—at less cost.

Mail Coupon for Catalog

In this *Light-Weight* Oil-Pull, Triple Heat Control, Oil Cooling, Dual Lubrication and all the famous OilPull principles of construction have been retained. It is still the famous OilPull with many improvements and refinements The design is small, light, compact, easy to handle and maneuver.

Mail the coupon. Get the complete catalog which completely describes *Light-Weight* OilPull tractors. Address Dept. L.P.

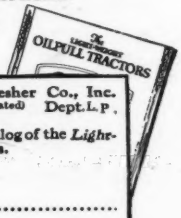
ADVANCE-RUMELY
Thresher Co., Inc. (Incorporated) **La Porte, Ind.**

The Advance-Rumely line includes kerosene tractors, steam engines, grain and rice threshers, husker-shredders, clover and alfalfa hullers, silo fillers and motor trucks.

Serviced through 33 branches and warehouses

The Light-Weight
OIL PULL
The 10-Year Tractor

"GOOD EQUIPMENT MAKES A GOOD FARMER BETTER"



Advance-Rumely Thresher Co., Inc.
La Porte, Ind. (Incorporated) Dept. L. P.

Please send me free catalog of the *Light-Weight* OilPull Tractors.

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105% Ahead!

The entire industry's production of motor trucks increased 23 per cent during the first eight months of 1925.

Graham Brothers Trucks in the same period increased 105 per cent!

A magnificent tribute to Graham Brothers policy of maximum value at minimum cost.

1 Ton Chassis, $995; 1½ Ton, $1280; f. o. b. Detroit

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REAR WHEEL FOR INDUSTRIAL FORDSON
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EXPANSION STEEL WHEELS

equipped with expansion wedge devices in rims require only a hammer and an ordinary wrench for mounting or removing rubber tires.

Light Weight — Ample Traction

Excessive weight in wheels reduces the capacity for pulling loads.

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KING Ventilating Systems are built to carry off the excessive moisture and foul gases from buildings in which they are installed and to bring in an abundance of fresh air without causing drafts or lowering the temperature to an uncomfortable degree. Whatever the wind velocity or other weather conditions the system functions continuously and automatically.

King Systems have long been used for farm buildings, creameries, cheese factories and warehouses where they have created the standard for ventilating efficiency.

KING VENTILATING SYSTEMS
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KING AERATORS *and* SYSTEMS

Easy to Operate

WESTINGHOUSE ELECTRIC

Solving the Farm Problem

ELECTRICITY has helped solve the problems of many of the nation's industries. Steel mills, factories, mines, and shops owe much of their progress to electrification.

Farm light and power plants now in use are saving thousands of dollars annually for their owners. They are:

—simplifying labor problems
—improving sanitary conditions
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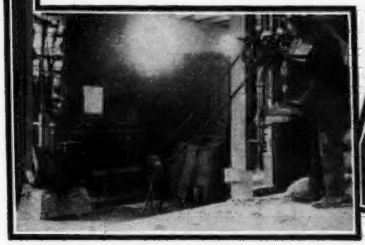
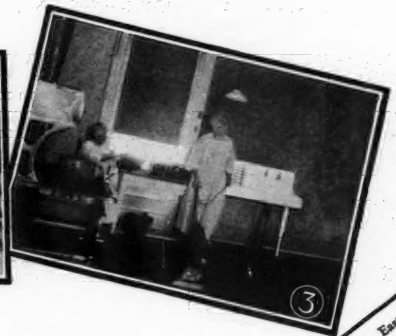
—increasing production

Electricity is the basis of modern farm convenience, as well as the economical solution to many farm labor problems.





1 Electric power saves labor, money, time, and temper.

2 While the fodder cutter in the loft of the Davis Dairy Barn is operated from a line shaft, belted direct to the Westinghouse plant, the worker on the floor below is operating a drill press.

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Farming Section, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
I am interested in farm electrification. Please send me literature on this subject.

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Complete Water Systems

Electric and engine driven Power Pumps for belt drive.

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For irrigation, drainage, etc.

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Descriptive literature on request.

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A.S.A.E. Publications

1923 Transactions

The 1923 A.S.A.E. Transactions (Vol. XVII), containing papers and reports of permanent reference value to the engineer or investigator, presented at meetings of the Society during 1923, may be purchased from the headquarters of the Society. The price to members is $1.00 and to non-members $2.00 per copy. Only members of the Society who paid dues in 1923 are entitled to one copy without charge.

Land Clearing Bibliography

The Committee on Land Clearing of the American Society of Agricultural Engineers has compiled a complete bibliography on land clearing. It is available in mimeograph form and can be purchased from Society headquarters. The price is 25 cents per copy to members and 50 cents per copy to non-members.

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For Consulting Engineers

AGRICULTURAL engineers, who are doing consulting work or who wish to build up a consulting practice, will derive much benefit from carrying an advertisement in this Directory of Professional Agricultural Engineers. There is an increasing demand for the services of consulting engineers in the agricultural and allied industries. Those who seek to render service in this field will find that a card in this directory will help to establish their name and service in the profession.

Rates for professional cards like the above—size 1 by 3½ inches—are as follows:

To A. S. A. E. members: $2.00 per insertion for not less than 12 consecutive insertions; $3.00 per insertion for less than 12 consecutive insertions.

To non-members: $4.00 per insertion for not less than 12 consecutive insertions; $6.00 per insertion for less than 12 consecutive insertions.